THE ELECTRICAL WORLD

A Weekly Review of Current Progress in Electricity and its Practical Applications

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Testing Laboratories.

It is noteworthy that the advantages and the value of thorough, systematic testing in electrical work are better understood and appreciated at the present time than they ever were before. Experience seems to have gradually forced electricians to realize that in order to arrive at precision, efficiency and economy in the results obtained by the agency of electricity, it is absolutely necessary to examine carefully every portion of the apparatus, and to watch closely every step of its operation, by repeated tests, just as the engineer does with the machinery under his charge, in order to detect at the earliest moment the trifling, but which, when multiplied several times, introduce important errors in the results. The galvanometer should be placed exactly in the magnetic meridian, and the place it occupies should be so disposed as to be entirely free from accidental or incidental vibrations of the building or the apartment. It should occupy a rather stable position isolated and removed from any disturbing influences such as pieces of iron or conductors carrying currents. In addition to this the connecting wires should be conveniently arranged, and as much out of the way as possible, so that the apparatus may be accessible without liability to derangement when the adjustments need to be made. We have known much inconvenience and delay, made than with the most sensitive apparatus improperly used.

We present herewith illustrations from *La Lumière Electrique*, of what might be called "model testing laboratories." Fig. 1 is a laboratory recently fitted up by M. J. Carpentier. In order to isolate the galvanometers, electrometers, etc., from all vibrations, it is customary in laboratories to securely fasten the slab on which they are placed to a thick wall, or to place them on stone pillars having deep foundations of masonry in the ground. But this remedy is not always effectual. In one instance it was found that the vibration of the ground, due to heavy loaded vehicles in the street, caused vibrations in a slab

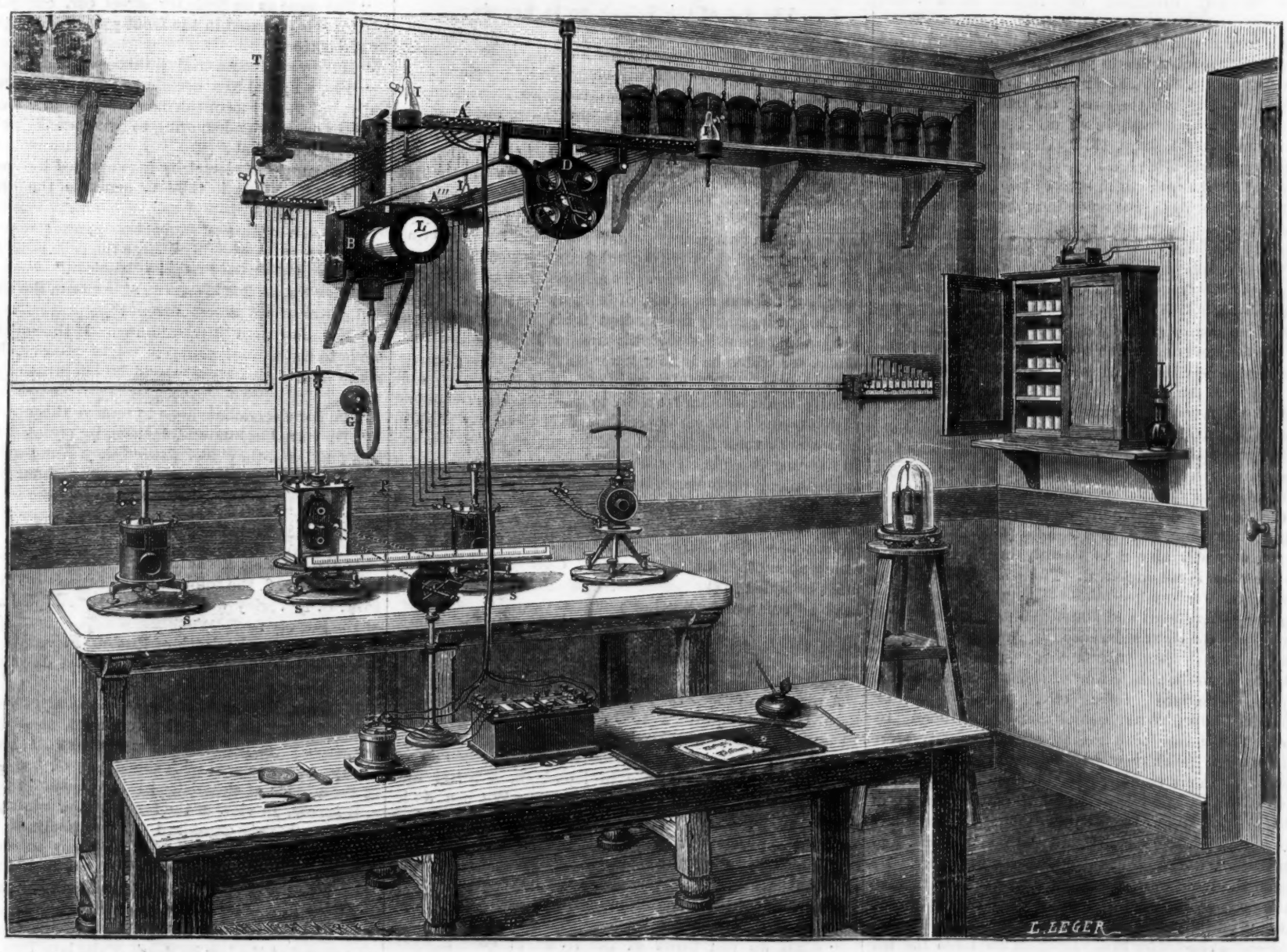

FIG. 1.—TESTING LABORATORY OF M. CARPENTIER, PARIS.

least deviations from the normal working conditions. It is this exact analysis of the work in all its details by frequent, accurate tests, that allows them to determine whether, where and how improvements can be effected.

The utility of electrical measurements being conceded, everybody will agree that they should be as accurate as possible in every case. In many instances the question of convenience is also an important consideration. The facilities for such tests therefore dictate the employment of sensitive apparatus with a proper disposition of accessories, so as to make the conditions as favorable as possible to accuracy and convenience.

The use of a sensitive instrument like the Thomson reflecting galvanometer, for instance, demands many precautions to eliminate sources of error which appear very with not a little profanity, to be caused in the laboratory by dangling wires carelessly lying around galvanometers. Those who do not feel inclined to begin to readjust an instrument over again, just as a test is to be made, usually appreciate the importance of not having too many loose wires around their apparatus. In a testing-room, as everywhere else, there should be a place for everything—batteries, rheostats, condensers, switches, etc., and, above all, everything should be in its place, instead of being heaped up usually in the way of the experimenter. We have seen some tests made under precisely such conditions, but we do not commend the results, which are as unsatisfactory as the method of getting at them. Our own observation is that with poor apparatus and good system, more accurate and reliable tests can be imbedded in a wall over two feet thick. In this case a new expedient was adopted. The stone slab, on which are placed the galvanometers, etc., rests upon a strong wooden bench or table, the four legs of which are laid on round blocks of rubber similar to those used for car springs. The texture of the rubber, the thickness and the surface, are made just right, so that the elasticity may be just sufficient to compensate for the vibrations communicated to the floor. The instruments are not placed upon the slab itself, but upon circular discs *S*, which rest on three rubber pieces, by which the instruments are further protected from vibrations. The discs are always to be placed in the same position, which is indicated by circles on the slab, and the instruments, when placed upon the discs, are always in line in the de-

sired direction, because their three legs are received in radial grooves drawn from the centre of the discs.

In the ordinary tangent galvanometer the length of the needle is increased by means of a "pointer" of aluminium or other light metal, so that by means of a longer needle slight differences of deflection may be made more readily appreciable. In the Thomson reflecting galvanometer the weight of this pointer would be very objectionable, and would dampen the deflection. For this reason the pointer is made *weightless*—that is to say, it consists of a ray of light reflected from a small mirror moving with the delicate needle of the galvanometer. It is evident that in this way the "pointer" may be made as long as desired, by simply moving back the graduated scale on which the reflected spot of light indicates the motion of the needle. Instead of employing the usual oil lamp to furnish the ray of light for each galvanometer, Mr. Carpentier has devised an ingenious way of supplying all the galvanometers from one common source which is a gas jet. The gas is taken from a side fixture *G* in the wall and conveyed to the magic lantern arrangement *B*, which is provided with a chimney *T* that carries off the product of combustion, at the same time preventing the undue rise of temperature in the room and obviating the condensation of watery vapor on the metallic portions of the apparatus. To obviate inconvenience the gas jet is lighted by means of the spark from an induction coil placed on top the little battery closet shown at the right, the current being obtained from one cell of Grenet battery placed on the shelf.

The lighting apparatus is provided with a reflector and a lens *L* makes the rays of light parallel as they emerge from the lantern to impinge on the reflecting device *D*, to which M. Carpentier gives the name of *mitrailleuse* because it serves to direct the light in several different directions. The device consists of a round case with five circular openings through each of which a portion of the light is received, whence it may be diverted in any desired direction by means of a small mirror pivoted on a universal joint. These reflecting mirrors can be placed either before or behind the case *D*. To each reflecting galvanometer corresponds a graduated scale. In the ordinary arrangement this scale-stand also supports the small oil lamp from which the beam of light is obtained. In this case it supports another reflector *M* instead (Fig. 2, p. 173.) There is a hair or fine wire stretched vertically across the opening in the case *D*, and this divides the beam of light into two. As this fine wire intercepts the light, the reflection made by the mirror on the scale, as shown by the dotted lines, will show a vertical shadow line, which is the line by which the deflection of the needle is read. The scale in this case is made of celluloid and is translucent. This innovation affords great convenience. Were not the scale transparent the electrician in charge would have to stand on the other side of the instrument table and look over or around the galvanometer to see the deflection. In this case the electrician may read the deflection from his seat at the small table, where he records it instantly. The celluloid scale is stiffened by means of a brass edge-piece. This edge-piece can slip in the grip which secures it to the supporting stand so that the zero of the scale may be moved to any point desired for adjusting or other purposes. A very weak light will suffice to make a visible line on the transparent scale. A common oil lamp, or even a candle (Fig. 2), provided with a reflector will give a sufficiently bright light even though the room is not darkened. The scale and reflector stand rests on the smaller table. This table is used for making the experiments and tests. The apparatus to be measured, and the standards, such as rheostats and condensers are placed upon this table as occasion requires. This plan is far preferable to that of placing the rheostats, condensers, standard cells, etc., permanently on the testing table, with connections controlled by switches. The latter plan seems, at first sight, more convenient since the change of combinations may be made readily and without trouble, but the complication of the circuits, switches, connections, and the encumbrance of the table are apt to prove quite annoying. It oftentimes requires a diagram to keep in mind the connections, and the confusion is the cause of much unnecessary delay. By placing on the table only the apparatus required in each case, the matter is much simplified and the operation of testing is on the whole expedited. In the figure is seen a rheostat and a condenser thus placed on the table for use in making tests. The battery used in general tests is placed on a shelf, as shown in the figure. There is a wire leading from each cell to a plug switch-board, by means of which the cells may be connected in groups of any desired number.

The cells in the small closet at the right are used for charging the electrometers. The connecting wires used for connecting the different accessory instruments with the galvanometers are placed along the walls on a board *P*, from which they ascend to supports *A'' A'''*. From this point they go across to another horizontal support *A A'*, held by the arm which supports the *mitrailleuse*. Then they terminate in binding posts and the connections leading to the instruments and apparatus on the test table are made by means of a cable, as shown in the figure. For the electrometers the wires require more perfect insulation, and they are supported by small insulators *I I I I* of the Mascart type.

The testing laboratory of M. Carpentier seems to us to be well disposed and fitted in all respects. Everything is arranged with regard to convenience, yet without crowding the room. In short, it affords much that ought to be suggestive to those who have to make tests and measurements, and who see room for improvement in their laboratories.

Abuse of the Messenger System.

According to a Pittsburgh paper, the district messengers of that city are exposed to vicious influences. It appears that the boys are made use of for other than strictly moral purposes—that is, they are frequently called upon to carry a message to and from houses of ill-repute, and run questionable errands. This has attracted no little notice from the public, whose attention has been drawn to the practice by the press. Mr. Henry Melzgar, of the Central District Telephone company, on being spoken to concerning the matter, said that the company did not deliberately permit their boys to carry such messages, nor did they put call boys in such houses. On the contrary, they endeavored to exercise the utmost care that their employes were not parties to anything improper. But when it came to deciding with regard to a question of morals where surface appearances were all right, the company didn't propose to engage in that business. Their service was for the public benefit, and he didn't well see how the company could take any more precautions than they were doing without infringing on the rights of others. Such people had the right to use the postoffice, the telegraph, the streets, the railroads—in a word had every right enjoyed by everybody else, so long as they conformed to the laws. Where a boy was asked to deliver a message, the nature of which neither he nor the company could know, without violating the sanctity of a seal, the company could not refuse. It would seem to be rather the duty of the parents to take care of their sons' morals.

The Aid of the Telephone in Frauds.

On this side of the Atlantic we have lately been considering the legal aspects of contracts made by telephone. It is natural that kindred points should arise from time to time here and elsewhere, and we now have one that deserves the notice of ventriloquists. Concerning this, the *Pall Mall Gazette* says: It is interesting to note the way in which the progress of fraud keeps pace with that of science. It seems clear that forgery, which indeed has long ago reached its limit as a fine art, will gradually pass out of fashion as modern business comes to be more and more conducted through the telephone instead of by the post or the telegraph wire. To a barrister's clerk at Birmingham belongs the credit of being the first to show how fraudulent ingenuity must adapt itself to the new conditions, and the robbery of his master through the telephone, for which he is now "wanted," was a very clever performance. The golden rule of art is simplicity, and nothing could be simpler than to connect the telephone with a friend of his employer; but to successfully imitate his master's voice in asking for the loan of some money, and adding that the clerk should be sent to fetch it, was a more difficult business. The subsequent forgery of a telegram to call the barrister into the country was comparatively easy, for the clerk was a past master in the art, having already undergone a term of imprisonment for filling up another master's checks. Clearly ventriloquism must be added to the list of "technical" subjects which have a "commercial" value.

The Light in Michigan.

A reporter of the *Free Press* called upon Mr. Field on Saturday, and inquired as to the purpose of the Excelsior Electric Company, of that city.

"We propose," said Mr. Field, "to give the people of Detroit, and of every city in Michigan, a better and cheaper light than they are now getting. We can do it, and we are going to do it speedily. I start for New York to-night to purchase the plant."

"Where will the plant be located?"

"That is not yet fully decided. We have several sites in view, one of them being the southeast corner of Woodbridge and Eighth streets."

"What do you think of the future of electric lighting?"

"That is yet at the beginning. The Excelsior Company has made a long stride toward perfection. It will be the light of the near future, and can be furnished at much less than present prices. Why, Brush has a royalty of forty-eight per cent. on the net profits of his machines wherever used. Think of that! No wonder he is already a millionaire."

"Is it not probable that electric lighting companies will spring up by the score?"

"No; for there are many valid patents standing in their way."

"Do you intend to establish the Excelsior Hochhausen system outside of Detroit?"

"Yes, indeed. We have already received applications from Port Huron, Ann Arbor, Adrian, Jackson, Saginaw, Lansing, Kalamazoo, Big Rapids, Niles, Flint and other places. We intend to establish it wherever the people want it, and we believe it will be wanted everywhere."

"Can it be used advantageously in private residences?

"Yes, and at a mere bagatelle of cost when the quality of the light is considered. For residences we shall use the incandescent light, different from Edison's, and better, because of the steadiness of the light."

"How about danger from fire?"

"There is none. Our wires are perfectly insulated."

"Now as to the cost? The public is chiefly interested in cold figures."

"Upon that point I have only to say that we are going into this thing to make money, and do not propose to give away our light, *but* we shall go into the market in competition with other systems, and shall give a better light, and for less money, than any of them."

An Electric Motor in San Francisco.

About a month ago we called attention to the proposed use of an electric motor on the street cars in San Francisco. We learn from the *Chronicle* of that city that the City Railroad Company has for some months past had under construction at its shops on Mission street in that city an electric engine, the electricians Molera and Cebrian being intrusted with the supervision of the machinery and work. A reporter visited the shops of the company lately, where the superintendent, E. De Witt, was found.

"I understand that your company has built a railway car to be run by electricity?" he was asked.

"Yes, sir, we have had one built here," replied Mr. De Witt.

"What is the principle of its motive power?"

"Stored electricity."

"Please explain the term 'stored electricity.'"

"Well, a steam engine is used to generate electricity in a battery of some sixty old cells, which when thoroughly charged with the electric current develops a power strong enough to move a car."

"What kind of car?"

"The same as an ordinary street car, excepting that a platform is prepared in the front part of it for the storing of the battery."

"Have you given a trial to this electric car?"

"Yes, sir; and to a certain extent it operated successfully, but there was one decided objection, which the electricians are now endeavoring to overcome."

"What was that?"

"The supply of electricity is exhausted too soon."

"How long does it take to generate the electric current?"

"A steam engine of eight horse-power requires about five hours to thoroughly charge the cells with a sufficient quantity of electricity to propel the car."

"How long a time were you able to run the car with the full power of the stored current?"

"Not more than thirty minutes. If the supply could be made to last several hours it might answer, but the expense attending its use would be too great to make it of value."

"Do the electricians hope to remove this objection?"

"They are busy now, I believe, in trying to overcome this fault, and they feel assured they can produce a battery that will run a car several hours without renewal."

New York Electrical Society.

At the meeting of the New York Electrical Society on Friday, Nov. 2, the following resolutions on the death of Prof. C. F. Varley were unanimously adopted as the sense of the Society:

Whereas, By the death of Prof. C. F. Varley the science of electricity has lost one of its most devoted disciples; and

Whereas, By reason of his professional connection with the laying of the first Atlantic cables, as well as by his numerous electrical writings and inventions, his name will always be associated with the history of the development of the science of electricity in the nineteenth century; and

Whereas, In view of the foregoing, it is but proper that we, as a society organized for the study of the science of which the late Prof. C. F. Varley was so industrious a student and so successful an exponent, should make suitable expression of the sorrow with which the announcement of his death was received by us. Therefore it is

Resolved, That this Society does hereby express its sincere regret at the loss by death of the late Prof. C. F. Varley; and further

Resolved, That a copy of these resolutions be spread on the minutes of this Society; and also

Resolved, That the electrical papers of New York city be requested to publish these resolutions.

The lecture on "Measurement of Velocities by Electricity," which was to have been delivered by Mr. F. W. Cushing, electrician for the Postal Telegraph Company was indefinitely postponed on account of the unexpected absence from the city of that gentleman. In lieu thereof Mr. James Hamblet, of the Time Service, made some interesting remarks on the subject of synchronizing clocks by electricity.

The membership of the Society was augmented to the extent of about a dozen names.

Mr. J. H. Emerick, superintendent of the Postal Telegraph Company, was elected a member of the Executive Committee, *vice* Mr. E. C. Cockey, resigned.

Electric Lighting in Railroad Cars.

It is claimed that the problem of lighting railroad cars by electricity has arrived at a practical solution in England. The "Cheeswright Railway Electric Light" is actually in partial operation on the Great Northern Railway, and carriages are being fitted for it on the Southwestern and Great Eastern and some other lines. It dispenses wholly with steam engine and dynamo for its supply, and depends solely on the old voltaic battery with certain novel combinations of the elements. An exhibition of this system took place last month at the offices of Mr. William Gammon, Manager of the South Wales Department of the London and Southwestern Railway. Six incandescent lamps, of about six-candle power each, were supplied from a battery of nine cells, and they gave an excellent steady light. A number of gentlemen interested in the lighting of railway carriages, which is the leading object of the patentees, were present and expressed decided satisfaction with the steadiness and brightness of the light and the extreme simplicity of the apparatus. It was stated that eighteen of these lamps, equal to 160 candle-power, suffice for a Pullman car, that the whole weight of the battery would not exceed three and one-half hundredweight, easily carried beneath the vehicle, and that a single charge would last from twenty to twenty-five hours. The current can be switched on and off with ease, so as to light or extinguish all the lamps of a carriage, or, if connected, of a whole train instantaneously. A single installation for a railway carriage would cost from $50 to $60, which is said to be not more than the first cost of gas. It is claimed further by Mr. Zobrab, the engineer in charge of the apparatus, that the elements employed can be sold after they have done duty in the battery as chemical compounds, for as much value as they cost in the first instance, and that the price of working would be not more than that of gas, and for a superior light.

The Siemens Family.

The late Ferdinand Siemens, of Hanover, had eight sons, of whom five are now living, all of whom are gifted with inventive genius. Under the firm name of Siemens & Halske has been founded a vast establishment for the application of electricity and magnetism to the industrial arts. Werner established the pneumatic dispatch system in Germany, also the block signal system on railways, The three firms in Berlin, London and St. Petersburg are the common property of the brothers, Werner, William and Carl. There are numerous branch establishments all over Europe.

The London brother, William Siemens, is a joint inventor with Werner of the differential governor for steam engines and sole inventor of the double cylinder air pump and also of a celebrated water meter in use in this country and Europe. His greatest invention, jointly with his brother Frederick, is the regenerative gas furnace. He planned and has built the well-known cable steamer Faraday.

Several Atlantic and other cables were manufactured at the great works of Siemens Brothers, at Woolwich, and Carl Siemens laid the direct United States cable. He is not so much of an inventor, but has greatly aided his brothers in extending their inventions. He is at the head of the establishment in St. Petersburg, where is situated the Siemens' large manufactory for telegraph apparatus.

Transmission of Force.

A correspondent of *L'Electricité* sends to that paper further details of the experiments on the transmission of force recently carried out by M. Marcel Desprez, at Grenoble, from which it would appear that they were far from being a complete success. The generator was placed in the cement factory, of Damaye et Cie., at Vizille, where there is a water turbine of 80 horse-power. A double wire of silicate bronze passed by the usual telegraph posts along the Vizille road to the Halle at Grenoble, a distance of a little over nine miles. Telephonic communication was also established. In the Halle, around the receiving instrument, were grouped a perfect collection of implements, a bandsaw, a circular saw, a printing press, a Dumont centrifugal pump, etc., all waiting to be animated by the power at Vizille. The receiving instrument used was the same that had served in previous experiments, having undergone the numerous repairs which seem always to be necessary after such trials under M. Desprez. In the present case he hoped to lessen the effects of distance by increasing the tension, relying on a perfect insulation of his apparatus for obviating the dangers of the latter. He therefore diminished the diameter of the wire wound on the coil while increasing its length. When, however, the select public was admitted to see the result of all the implements, only one was to be found in action, *i. e.*, the centrifugal pump, which was creating an artificial cascade with pretty effect. On the Sunday, the committee charged with the preparation of the official report certified an active force of 7 horse-power (measured on the Prony brake) at Grenoble, while the generator at Vizille was making 1,257 revolutions, and indicating from 45 to 50 horse-power. This amounts to a practical transmission of 15 per cent., a result in accordance with the calculations of M. Cabanellas, but not at all with the hopes of M. Marcel Desprez.

Subterranean Cables in Washington.

In a recent issue we stated that the Standard Underground Cable Co. had obtained permission to begin experimental operations in Washington. A dispatch of the 3d inst. from that city says that the company has commenced laying its cables from the Capitol and along the street northwest from North Capitol street to First street; thence it will be extended north to the different parts of the city. The intention is to lay at present about 4¼ miles of cable, with wires for three telephone lines and two Morse telegraph lines for the use of the United States and district governments. Twenty men are at present employed in doing the work. On Thursday last they laid about 800 feet of cable, and next day 1,000 feet. The superintendent says the average will be about 1,000 feet each day. With the force of men they now have the work will be completed in a week or 10 days. The cables are the same as have been in use on trial in Pittsburgh for 18 months past. They consist of six copper wires bound tightly with cotton thread and saturated with ozite, said to be the best insulating substance known, and incased in a lead cable about 1¼ inches in diameter. Each wire is separated from the rest by a thick lead coating, so that they can in no way interfere with each other. The cables are made at the company's factories in Pittsburgh. The process, the superintendent explained, was very simple, two men being all the force necessary to manufacture it. The wires are conducted through a mold so arranged that they will not touch each other, and lead poured around them and subjected to a pressure of 3,000 pounds to the square inch. This pressure forces the liquid lead around and between the wires, forming the cable. As many as twenty-five wires have thus been united in one cable, and an unlimited number might be so combined. Mr. Henry Van Hoevenbergh, the electrician in charge of the construction, told a reporter that he had tested all the cables to be used in Washington and found them perfectly satisfactory. The instrument used in testing the wires is a Thomson reflecting galvanometer. It is attached to the end of the cable in the vaults of the Capitol.

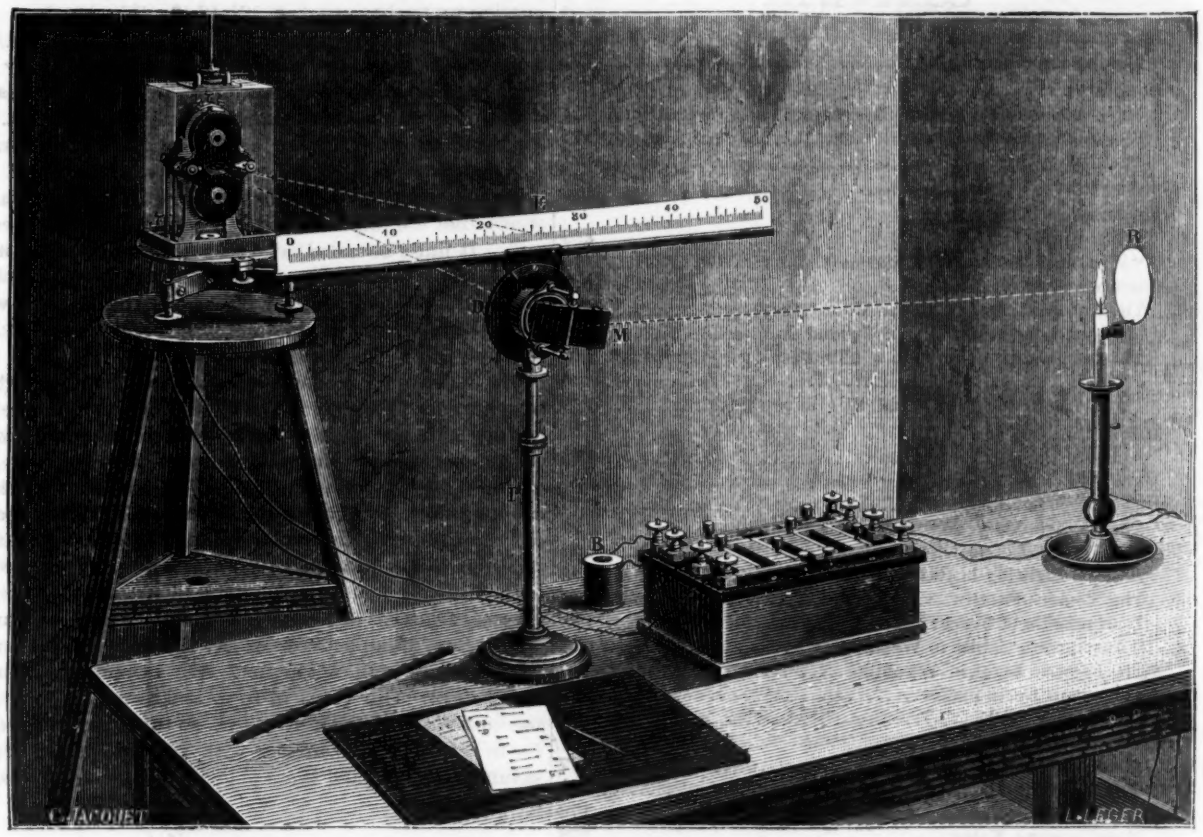

FIG. 2.—THOMSON REFLECTING GALVANOMETER WITH TRANSPARENT SCALE.

The Electric Light in Wyoming.

All prominent cities and towns in the country are now, says the *Laramie Boomerang*, illuminated by the electric light. Laramie a year ago, was visited by agents of the Brush-Swan companies, and a canvas of the city resulted in their receiving even more aid than they asked for.

A project is now on foot which promises to result in the lighting of at least a portion of the business houses with the arc light. Mr. W. H. Root has been appointed general agent for Wyoming of the Sperry Electric Light, Motor and Car Brake Co., of New York city, and has made a partial canvass of the business portion of the city with a view to putting in a plant of from one to five ten-light dynamos. It is proposed to sell each consumer his light, for all time, and do away with the vexation of renting them. Mr. Root says that the company offers to put in the plant—sending a competent man there for that purpose—and run it on thirty days' trial. If the subscribers are not then satisfied with the light, they need not take it—a very liberal offer, indeed. Each arc light is warranted to be steady and even, of 2,000 candle-power. From ten to fifteen lights have already been contracted for, and it is proposed to run the number up to twenty at least.

The Javan Earthquake.

An officer on board the United States man-of-war "Enterprise" makes an interesting report from Batavia on the great earthquake in the Straits of Sunda. In one part he says: "About a week after we reached the Straits of Sunda we had a phenomenal sunset, awful in its grandeur, that terrified nearly all on board. Just before sundown the heavens became quite dark and then suddenly changed to a dark green. After the sun had sunk behind the horizon it became light again and the green tint gradually died away, the color of the sky after a short while regaining its normal condition. On that very day and hour those terrible eruptions took place on the Island of Krakatoa, 700 miles away from us. Three days after this atmospheric phenomenon we noticed that the water was covered with a floating scum, which upon examination proved to consist of scoriæ and pumice."

He adds the following graphic description: "I have just seen the captain of an English ship that was near the island when the wrath of the storm and the earthquake fell upon it. He told me that the barometer just before any disturbance was noticeable began to fluctuate rapidly, dropping from 31 to 26 like a flash. He said that the atmospheric disturbances that soon followed, combined with the commotion of the waves, presented a picture that only hell as dreamed of by Milton could have equalled. Balls of fire crossed and recrossed the heavens and burst in mid-air, falling into the sea in innumerable fragments, accompanied by loud hissings. Heavy masses of clouds black as night rushed together from different points of the compass, and, whirling around and around, seemed to be struggling for the mastery. Towering waves seemed to come from every point of the compass and rushed together with terrific roars. Lightning leaped from the waves and was lost in the heavens. The wind, which was blowing cold, suddenly changed to a blast of heated air almost unbearable. The air was charged with electricity, and every man who took the wheel was instantly paralyzed for the time being, Scoriæ began to fall as thick as snow. After his ship passed out of the storm the captain said that the scoriæ on the decks and rigging was so thick that it took fifty coolies three days to sweep it into the sea. The Juniata has just returned from the scene and reports everything quiet now, with no indications of such another visitation being imminent."

RONDEAU.

IN THE TELEPHONE CLOSET.

Hello! Hello! My darling Nell,
I know your touch upon the bell:
It thrilled, as often does my heart,
When you, your loving glances dart.
I can't hear, dearest. Louder! *Yell!*

Speak slower, loved one, you must spell,
For what you say, I cannot tell,
We are so *very* far apart—
Hello! Hello?

I'm at the office, and must sell—
What do you say? To go to—well?
Good gracious! Tell me who thou art?
"Shut up, young feller, and depart!
I want the druggist—calomel!"
Hello! Hello!

—*H. L. Satterlee, in "Life."*

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Mr. Shelbourne's Views on Telephonic Transmission.

In another column we publish a second communication from Mr. S. F. Shelbourne, in which he criticises our previous comments on his conception of retardation, and takes occasion to characterize the accepted theory of mechanical vibration, varying in rate according to pitch, in the telephone diaphragm, as "arguing across lots," or "a backward process the outcome of *a posteriori* habit." We believe that if our correspondent had argued a little more "across lots," instead of arguing all around and all over the lot, he would have saved himself some trouble and us some space in his discussion. It seems that our last criticism was insufficient to convince him of his error. He proceeds this time to advance a new theory of telephonic transmission, to replace the mechanical vibration theory. But all this fine logic and sentimental phraseology does not argue to any purpose. If our correspondent has ever heard of an instrument called a phonograph, and especially if he has seen one, he must know that a "little circular diaphragm" *is* capable of compassing the whole range of vibrations, from bass to high tenor, and not only of changing the number required for each pitch, but of moving so as to reproduce several pitches simultaneously. The indentations in the tin-foil are irrecusable evidences of such vibratory motion. Perhaps Mr. Shelbourne may not know it, but it is a fact, nevertheless, that the membrane of a phonograph can be made to transmit the voice just like a transmitter, if provided with the usual microphonic transmitter contacts. This shows the rôle which the motion of the transmitter diaphragam must play in the operation of transmitting the voice. Now, let us see whether we can obtain such evidence of vibratory motion at the other end, the distal (!) end of the line. Let the magnet of the receiver operate the diaphragm of a phonograph, instead of its own diaphragm. The result is that the voice is *recorded*, as shown once more by the indentations in the tin-foil, which could certainly not have been produced without an actual vibratory motion of the receiver diaphragm. But our correspondent cites the telephone experiments between Chicago and New York, and calculates that it would be impossible for the undulations to be transmitted at the required rate, owing to the distance. Let us see what were the actual conditions. We gave the limits of pitch between which telephonic sounds usually occur as between 150 and 1,000 vibrations, but the average number, 575, taken by our correspondent, is much out of range. The average tone of conversation during the experiments was probably of around 200 vibrations varying not much higher and probably lower. This would correspond to 400 alterations as the maximum. In the Gray harmonic system, which is, by the way, a crude telephonic system, reeds vibrating from 200 to 400 are used between here and Chicago, thus proving the capacity of wave transmission up to that number. Not only this, but four reeds are made to send impulses over the same line and these superposed impulses preserve their individuality well enough in the cause of transmission to resolve themselves again into distinct tones in the receiving instruments. The high rate of transmission at which the Leggo automatic telegraph system has been operated over the Postal Telegraph Company's wire between New York and Chicago shows that 600 impulses can be easily transmitted per second. It must be noted also that the articulation in the telephonic experiments was none of the best, and it probably failed to reproduce exactly those syllable pitches which were too high, and the undulations of which were blended together in the process of transmission.

We hope we have shown our correspondent enough reasons why his theory is "respectfully declined." We have neither time nor space to follow him in his generalization of the phenomena of light, sound and electricity, nor can we adopt his "finer and more spiritual view of electrical causation through conductive media," and his doctrine of "spiritualized molecular force," because these are extraneous to the question under discussion. If this were a metaphysical journal we might discuss with him the ethereal frailness of his bold philosophy, which reminds us of the Rev. Joseph Cook or A. Bronson Alcott, but we must refuse to follow further. We cannot soar quite to that height. Our views of force and its manifestations are too *material* and too *mechanical*, so to speak, and we prefer to remain on the surface with Tyndall and all modern savants, who regard these phenomena in the same light as we do.

Electricity and the Supply of Gold.

It is said, and with truth, that the great financial fact of our times is the prevalence of low rates of interest. No matter where we may look, the return of interest on capital is now much lower than it has been, and the tendency is still toward reduction. This feature of modern development has not escaped notice. It has been discussed by eminent political economists from time to time, and one of the latest contributions on the subject is Mr. Henry George's "Progress and Poverty," in which interesting work the relations between rent, interest and wages are elaborately treated. Mr. George's object is to establish the truth that as rent rises, owing to private ownership in land, interest and wages will fall; and he advances many weighty arguments in support of his propositions, although he does not explain why, in a country like England, where the value of farming land has of late seriously deteriorated, the rate of interest does not rise again to its old figures. It is well known that a pet project with Mr. Gladstone is to refund the consols into a new obligation that should bear only two and a half per cent. interest, but it is not so long ago that five per cent. was regarded in England as the rate of interest fixed by Providence on all sound investments. In this country the rate of interest on the national debt is steadily declining, and money is about as cheap in New York as in London.

But while the rate of interest appears to be permanently low, the demand for gold is reported larger than the supply. The reason of this is the inquiry that has arisen for gold in this country, Germany, Italy and Holland. In 1857 the increase of the gold supply was viewed with concern, even with alarm, but now anxiety is caused by exactly the opposite condition of things. Between 1852 and 1856 the supply was $150,000,000 per annum; then it dropped to $123,000,000, and now it is only $100,000,000

Should this marked decline continue, it is by no means improbable that the metal will appreciate and prices fall. We leave the study and working out of the problem to men of the money market, financiers and economists. Our object in calling attention to these facts is simply to express an opinion that in some degree electricity must be held accountable for the lowering of the standard of rates of interest and for preventing the decline in the production of gold being more keenly felt. We cannot help noticing that this theory, as applied to goods, has the support of the London *Saturday Review*, which says, in the course of a recent article: "The laying down of telegraph wires over the land and under the sea has brought the whole world into close and constant communication. The use of the telegraph enables merchants to supply themselves as they require. Formerly, from the difficulty of communications, merchants had to keep immense stocks of goods in their warehouses, and consequently needed enormous capitals to carry on their business; now they have only to telegraph to New York, New Orleans, San Francisco, Melbourne, Bombay or Shanghai for what they want, and they can calculate to a nicety how soon the goods will be landed." In other words, the conditions of trade are already radically changed, and the same amount of money will do much more work than formerly. More than this, capital itself is rendered more available, and by means of the land wire and sea cable flows hither and thither freely, seeking its level. This being the case, a large amount of capital, in spite of the decline in gold production, is released from wonted service, and its competition for safe employment keeps rates of interest low. There can be no doubt that electricity, in thus facilitating the movements of capital, has been very influential in the money markets of the world, and gives another evidence of its growing potency.

The Right Kind of Young Men.

In THE ELECTRICAL WORLD of Sept. 15th we stated that "the younger son of the famous war governor (Andrews) is engaged by the Pittsfield telephone management as repairer and lineman. Mr. Andrew is learning the business with a view of a responsible office in the eastern part of the State. He has spent one year in a factory, and is now learning all the practical working of a telephonic exchange. To don old clothes and visit residences where in full dress he has attended evening parties requires a kind of nerve which ought to make a successful telephonist."

A contemporary, the name of which we do not know, refers to the subject and makes some very sensible remarks, which are being copied by many journals. As electricians ought to feel an especial interest in the matter, and as we like to encourage such commendable conduct in the young men engaged in the various practical applications of electricity, we reproduce the comments for the benefit of our readers, as follows:

That young man's grit is indeed remarkable in this age of dudism and cigareticide. When a young man makes the best of the circumstances which surround him, when he will take off his coat and engage in honest labor, not afraid to soil his hands, he is the man that will be able to successfully meet any emergency. He is one of natures' noblemen. A young man who, by force of circumstances, has courage enough and strength of character enough to unhesitatingly put on the garb of a mechanic and enter the house to work as a mechanic, where in the days gone by he has entered in full dress, one of a company of wealthy young men, that young man is composed of the stuff that makes *men*. He is an honor to himself, his family and his country. He has force of character that gives him true independence that laughs at what his former companions may say, or at their snubs and jeers. He is bound to rise in the world, and nine out of ten who have this independence, live to see the day when those who snubbed them will be glad to accept aid—the bread of charity from the hand they refused to take a few years before because it had the callous of honest toil that is far more honorable and beautiful than the glove upon the hand, which is not earned by the wearer. When a young man is in a position to afford all the fine personal adornments; when he has money enough at his command to live without work, he certainly has a right to spend it as best pleases him. But if to this there be added that force of character that will enable him to step into the ranks of the honest mechanic should a time come when his money takes unto itself wings and flies away, he is indeed a man whom the whole world should be proud to honor. There are, however, too many ten-dollar-a-week young men who try to assume the airs of millionaires. If these young men would stop for an instant and think of the utter impossibility of success in such an attempt, they would soon change their course, as they would realize that such is not the stuff men are made of.

An Electric Watch.

Last week we mentioned that according to a cable message, a young Jew of St. Petersburg named Schisgal had invented a watch that goes by electricity. Herr Chowlson, Professor of Physics at the University of St. Petersburg, has written an article on the subject in the *Nowosti*, in which he says: "In its remarkable simplicity this invention can only be compared with the Jablochkoff system of electric lighting. The watches are without any springs, and consist solely of two wheels. Besides being true, they have the advantage of the second hand moving in single momentary leaps, as is usually the case only in very costly

watches, and which is of the utmost utility for astronomical observations. These watches can also set in motion a certain number of watches of the same construction, so that they all keep exact time. The invention has convinced me that watches can be used for the purpose of telegraphy." After naming several other advantages, Prof. Chowlson describes the invention as a wonder which will cause an entire revolution in the manufacture of watches. Herr Schisgal is the son of a Jewish watchmaker in Berditschew.

Reviews of New Books.

ELECTRICITY IN THEORY AND PRACTICE, *or The Elements of Electrical Engineering.* By Lieut. Bradley A. Fiske, U. S. N. D. Van Nostrand, New York. 8vo, 270 pp., 180 illustrations.

We have been favored by the publisher with advance sheets of this new work, which has just been published. The scope of the book, as showed by its title, differs from that of the many books extant treating on electrical science and its applications, insomuch that it aims to bridge the gap or distance between theory and practice. Instead of confining himself solely to the elucidation of theoretical and fundamental principles or to the description and discussion of practical details, the author has sought to plow a new furrow in the broad field of electrical literature by striving to harness theory and practice together. We are sure that there are many readers and students who will appreciate this new venture on his part, because it furnishes them the connecting links which they need to blend into a harmonious whole the theoretical or practical knowledge gathered from various quarters.

The book is divided into eighteen chapters. Magnetism is the subject which is assigned the first place in the book. because, as the author states in beginning, "it is through the medium of magnetism that the principal applications of electricity are made in the arts." The consideration of "Frictional Electricity," which is the somewhat conventional subject-matter of the first chapter in most text-books, is relegated to the record chapter in this case. This is a commendable plan. We would remark, however, that in our opinion the author could have improved the first chapter very much if he had departed still more from the usual method of presenting the subject. In view of the great and increasing importance of the applications of electricity produced by dynamo-electric machines, the much discussed and mysterious "magnetic field" should certainly be treated as fully and clearly as possible. There is a positive void on the subject in our contemporaneous literature, and yet the matter seems to be slighted to a certain extent by all authors. Faraday's conception of lines of magnetic force is accepted and adopted by all the foremost-thinkers in our science as the most simple, comprehensive and logical analysis of all phenomena in which magnetism is concerned as a factor. It gives an insight into the *modus operandi* of each operation, and enables one to reason to advantage. This is the easiest, clearest path through which the student can be led to a sensible understanding of practice, especially when every magnetic reaction, in attraction, repulsion, etc., is made the subject of ocular demonstration by magnetic spectra. This is the method which Faraday himself adopted and recommended, and we consider it a golden opportunity for some author. In the chapter (VIII.) on Electro-magnetism the author dwells more fully on the properties of lines of magnetic force, but much of this explanation would have been of greater benefit if embodied in the first chapter. There is little if anything said anywhere of the influence of masses of iron in magnetic fields on the distribution of the lines of force, though this point is of extreme importance in the dynamo-electric machine. Chapter III., on "Work and Potential," is new and interesting. We have to take exception, however, to the author's definition of the C. G. S. Unit of Work, the "erg," which is as follows: "It expresses the work performed by lifting a weight of one dyne through one centimetre. A dyne is an extremely minute weight, being about $\frac{1}{981}$ of a gramme." This definition is inaccurate, because, strictly speaking, a dyne, being the unit of *force*, it is wrong to call it a *weight*, even though it is in reality *equivalent* to a weight. The dyne is practically a unit of velocity or acceleration, for it corresponds to the force required to impart to the weight of one gramme, at rest, a velocity of one centimetre in a second, or to increase its velocity by that amount if it is already in motion. Now, the attraction of the earth (gravitation) will cause a gramme to fall to the earth with a velocity increasing about 981 centimetres per second. Consequently the force of gravitation is equal to 981 dynes, and one dyne is equivalent to $\frac{1}{981}$ of the force of gravitation exerted on a gramme, or $\frac{1}{981}$ of its *weight*.

It seems to us that the idea of potential could be conveyed in fewer words and more clearly by means of analogies more wieldy and assimilable to the subject than the hypothetical case selected by the author. However, the subject is quite well laid bare, even though it is at the expense of considerable space and the chapter may be considered satisfactory enough. Chapter IV., on "Voltaic Batteries," is very excellent, not so much because it is exhaustive as because it is intelligent. It introduces the subject of polarization early and in good manner, and the types of batteries are classed with reference to the means, mechanical, chemical or electro-chemical, used to prevent it in each case. Chapter V. is very interesting. It contains a review of Ohm's law and its consequences, Joule's law, and touches also upon the electrolytic properties of currents. This chapter we consider very creditable to the author, as also the following (Chapter VI.), which is on "Secondary or Storage Batteries." The subject is briefly presented in a very satisfactory manner, and the rest of the space is devoted to a summary of the inventions and modifications which have appeared. The author wisely leaves out of discussion the question of efficiency. Neither does he say a word as to the utility of the storage battery and its applicability to individual cases, though we opine that a few details of this nature would have been interesting. Chapter VII., on "Thermo-electric Batteries,' is on the plan of the preceding chapter. The author draws attention to this field of research as one of the most promising in the science, because it points to the possibility of our obtaining electric currents directly from heat, instead of expending energy in incidental losses in dynamo-electric machines. A description of Noé's and of Clamond's thermo-electric batteries, with which practical results have been attained in Europe, would have been interesting in this connection. Chapter VIII., already refered to, and Chapter IX. on Induction Currents are quite creditable to the author. Chapter X., on "Electrical Measurements," is very complete, and constitutes one of the best chapters in the book. The subject is presented in a very lucid manner. All the various forms of galvanometers, including ampère-meters, and volt-meters, are described and their action explained. The Wheatstone bridge method is also explained, and the chapter ends with a reference to some of the most important measurements. We find that in the middle of this chapter the author has interspersed a reference to the voltameter, which, in our opinion, is out of place. It properly belonged with Chapter XVII. ("Meters"), or more properly Chapter XVII. should have been embodied in this one, for they all come under the head of "Electrical Measurements." The Edison meter is an electrolyzing cell of a peculiar kind, and its description should properly have followed the voltameter. The next three chapters are devoted to the applications of electricity: Chapter XI. "The Telegraph;" Chapter XII. "The Telephone;" Chapter XIII. "The Electric Light." These are all as complete as the brief space of a general treatise like this could allow. Chapter XIV., on "Electric Machines," is quite practical. The most interesting and typical forms of machines are described and the general principles clearly explained. The ending paragraphs on "Excitation of Magnets" and "Characteristic Curves of Dynamos," particularly the latter, are valuable and interesting. Chapter XV., on "Electro-motors;" Chapter XVI., on "Electric Distribution of Power," and the last chapter, XVIII. on electric railways, are undoubtedly the most valuable of the book, and will make it interesting to electrical engineers as well as to the general reader and the student. The chapter (XVI.) on electric distribution we consider, indeed, most excellent, and worthy of a place in a much more advanced text-book. To sum up, we deem the book a creditable addition to our literature, all the more so since the author attempted to fill a void never before touched by other authors. The last half of the book, which is by far the most important, is, as we have seen, comparatively free from objections. If, on the whole, it does not fill the void completely, it is perhaps because it would be physically impossible to do so in a small volume of this size; but Lieutenant Fiske's fills the largest portion of it, and we hope that it will be well received.

ELECTRICAL MEASUREMENT AND THE GALVANOMETER: Its Construction and Uses. By T. D. Lockwood. J. H. Bunnell & Co., New York. 12mo, 137 pp.; 32 illustrations.

This small manual is a welcome addition to our literature on the subject of electrical tests and measurements. It is surprising to find what ignorance prevails among electrical men regarding the intelligent use of a galvanometer—even among persons who enjoy considerable reputations as electricians. The galvanometer, and especially the Wheatstone bridge method of employing it in effecting measurements, remains an absolute mystery to them, and naturally the consequences appear in their results, which often reveal serious incompatibilities in the adaptation of means to ends.

Mr. Lockwood's book is a practical treatise, intended for practical men of this class, and it will doubtless prove a boon to them. The author's style is popular rather than technical, and he takes pains to explain every detail clearly. He begins by urging the necessity and value of measurements, and after a brief mention of "batteries" passes on to definitions of electromotive force, potential, current strength, resistance, single or joint, and in this way substantially analyzes Ohm's law, which is finally formulated and exemplified at the end of this portion of the book (page 26). We would remark, by the way, that the word ampère is spelled with the wrong accent wherever it occurs, thus "ampére." This is a slight typographical error, but it should have been watched more closely, because those who read the book may be led to follow the same error; whereas, if any accent is to be used at all in English, it should be the proper one. The next portion of the work is devoted to the galvanometer in all its types and modifications, and to rheostats and resistance coils. This portion, which embraces 28 pages, is very clear and plain, and will convey to all an intelligent idea of the construction of galvanometers generally; and of the Bunnell "Tangent" particularly, which is made the subject of a special description. The next few pages are devoted to the explanation of the Wheatstone bridge, and after a brief review of the different methods of making measurements, we find a description of the Bunnell Wheatstone bridge set, with illustrations and diagrams of connections, to which are added hints on "the management of the galvanometer and rheostat," and "practical hints for use in the Wheatstone bridge measurement," both of which will be useful to the learner. The rest of the book (p. 84 to 133) is devoted to" instructions and formulæ for measurement," in which is given an account of the most ordinary and useful tests, with diagram of the method in nearly every case, and with numerous practical examples. In referring to Mance's method of using the Wheatstone bridge for measuring the internal resistance of the battery used, and also to Sir Wm. Thomson's modification as used for measuring the resistance of the galvanometer, Mr. Lockwood calls attention to an important point which is not noticed by other writers on the subject. When the galvanometer is very sensitive, or the difference of potential between its terminals is great, the influence exerted upon the galvanometer needle may be so powerful that it will seem to remain the same even after a variation of resistance. Mr. Lockwood advises making the branches of the bridge unequal, or to use a shunt for the galvanometer, or to reduce the deflection by means of the influence of a permanent bar magnet brought near it. In addition to the various formulæ, the book contains tables of tangents and sines calculated in half degrees for convenience of reference.

The author, in his desire to make the book practical, and to steer clear of the odium which practical men, that is to say, empirists, attach to anything that savors of abstruse theory, has scrupulously avoided all use of algebraical formulæ, and he makes the proud boast in his preface that "arithmetic has been found sufficient for the formulæ contained in its pages." This is certainly a very creditable object, but we are under the impression that the author has run from one extreme to the other. A man may succeed in learning to use proper language without the assistance of grammar, but everybody is agreed that this road to knowledge is the longest way around. The study of grammar affords a knowledge of rules whereby important relations between words may be easily deduced, which he could only have learned otherwise by burdening the memory. So with mathematics. They not only serve to facilitate the elucidation of a subject by leading to conclusions and relations that would not otherwise be even suspected, but they paint the results in a condensed manner on our recollection, so that it is easy to recall them when needed. Not even the simple formula $C = \frac{E}{R}$, which expresses Ohm's law so concisely, is to be found in the book. The convenience of its use and the ease with which it brings to mind at once the three elements, current (C), electromotive force (E), and resistance (R), and explains their mutual relations, would have well repaid the few words necessary to explain it so as to bring it to the comprehension of all.

A simple formula to express the relation which the four sides A, B, C, D of the Wheatstone bridge bear to each other would also have been an improvement, in our opinion. It is far more convenient to remember a few letters than a whole rule. Thus the formula $D = \frac{B\,C}{A}$ shows at once how the result is obtained. What applies to Wheatstone formulæ will also apply to other measurements, the methods of which can always be kept in mind more easily when condensed into formulæ. Aside from this slight objection to the omission of algebraic formulæ, which the author and doubtless others look upon with favor, we consider the book quite worthy. We must call attention to another important omission, however. The author nowhere makes mention of a second method of using the Wheatstone bridge, in which, instead of a rheostat with adjustable resistances, a single standard resistance is used, and the balance, instead of being affected by unplugging resistance, is obtained by altering the ratio of one branch to the other. This method, sometimes called the "sliding bridge," is used to a large extent in Europe.

The Siemens & Halske portable galvanometer and Wheatstone bridge apparatus is constructed on this principle. This method, although perhaps not so absolutely accurate as the others, is rapid, and is very convenient in cases where a set of resistance coils is not at hand. Were it not for this little error of omission, the book would be a complete treatise. But even as it is, it is deserving of the consideration of all electricians who wish to familiarize themselves with the theory and practice of electrical measurement, and is, perhaps, the most satisfactory instruction book of the kind they could procure.

THE TELEPHONE AHEAD.—A gentleman of Durham, Conn., has his own opinion of the comparative value of the various methods of rapid communication. He recently received three messages from New London with the same news. One came by telephone without delay, the second by mail in four hours, and the third by telegraph in twenty-four hours.

The Nature of the Telephone Vibrations.

To the Editor of The Electrical World:

SIR: In your issue of Sept. 22 appears a criticism in the form of an answer to my article in the same paper which you gave the heading of "Underground Communication."

The critic does not dispute my statement "that sounds following each other in quicker succession than twelve per second produce upon the ear the sensation of a continuous noise," etc., but goes on to argue as to the *number of vibrations* required to give each pitch in the tone of voice and illustrates his ideas by reference to the pipes of an organ. In my article I was not dealing with *vibrations* required in the human glottis to produce voice itself, for I spoke distinctly of *voice changes*, meaning distinct articulations of speech, as indicated in written language, by syllables and like division of letters in expression.

But since your critic has opened that view of the subject, I wish to notice some of the logic he uses. One of his sentences is as follows; "In order to reproduce the vocal sounds faithfully at the distal (?) end of a telephonic line, *every vibration constituting each tone* must cause a distinct impulse of current to be transmitted over the line and for this purpose the electrical impulses must succeed each other at the rate of from 150 to 1,000 per second, according to the pitch of the tones."

The italics are mine, to call attention to the evident meaning of your critic. He can mean nothing else but that each tone of the voice must have as many vibrations in the telephone as will correspond in acoustics to each change in pitch of that tone. Now, since every vocal manifestation is made up of a beginning and an ending it must have inception, rise, crisis, decrease and termination of that decrease, as *oh—no*. Therefore the rise and fall of each tone or syllable or vocal effect may be represented by as many ordinates drawn from the curve of rise, crisis and deflection to the uniform level of the abscissa as will represent each gradation in distance of that curve from the abscissa. These ordinates to be faithful in number should be so closely drawn that it would take a microscope to distinguish them on a sheet of paper where an inch of space is given to represent the curve of a single syllable. Now multiply the number of ordinates by the number of vibrations required to produce the pitch represented by the length of each ordinate. Then take as a further multiple the number of distinct syllables or articulations of the voice in a second, which may reach perhaps four. To be within the consent of your critic, for he contends that "the electrical impulses must succeed each other at the rate of from 150 to 1,000 per second," we will take the average of the product of these multiplications to be the average between 150 and 1,000, which would give us 575 waves or electrical pulsations along the wire per second. I use the word *pulsations* as indicating the true idea of electrical waves, the *effects* of *impulses* which are the moving *causes* of the waves and ought not to stand in word for the waves or swells of the current themselves.

Now it must be remembered that in order to produce their proper effect, these waves must traverse as such, the whole length of the telephone line. But it has been shown by Prof. Henry that induced currents are caused both at the make and brake in the inducing wire, and the currents at the making and braking are in contrary directions. To apply these facts to the telephone, the beginning and ending of every *change, i.e.* the inition and transition of every degree in the voice wave in the transmitter, gives rise to *two* currents along the whole line in opposite directions. These must occur for each ordinate in the curve of the voice syllable or tone. This would give us, in the calculation, an average of 1,125 distinct induced currents along the whole length of the secondary wire per second. These currents must succeed each other *in time*, since each alternate one is in the reverse direction. It has been shown, moreover, within the last eight months that intelligible talk with clear articulation has been carried on over the postal telegraph wires, a distance of 900 miles, between New York and Chicago. That fact on our calculation would require a velocity of electric current more than a million miles per second, or more than five times the velocity of light.

But the greater astonishment arises when we consider the capacity of material substances to take on mechanical vibrations. If we give sharp, heavy sounds into the telephone transmitter the hearing diaphragm gives kinking or buckling irregular sounds, but we hear also, as it were, the faint thread of a spiritual song interrupted and fading away into distant nothingness.

Your critic illustrates his ideas of telephone vibrations by citing the bass organ pipe "32 *feet long*." Well, it shows truly that to produce given sounds the vibrating reed or medium must bear definite and arranged proportions to the sound or tone required. In Prof. Gray's harmonic system the vibrating tongues or plates have definite arranged dimensions.

In sustaining the mechanical theory of vibration for the telephone, will any one, can any one, say that the little circular diaphragm, only one and five-eighths inches in diameter, can compass the whole range of vibrations from bass to high tenor, and change the number required for each pitch of tone in the infinitesmal part of a second? To conclude that the telephone vibrations are altogether mechanical like those of a piano string, and that they are so many and so often changed per second, will require more and wiser demonstration than Prof. Bell has yet been able to give to the subject, while to reason that the telephone *must* have so many vibrations per second *because* the note or pitch of the sounds produced, corresponds to a given number of vibrations represented in the simple *mechanics* of sound, is either arguing across lots, or a backward process, the outcome of *a posteriori* habits—the application of *vis a tergo* in reason, which, instead of forward into light, looks backward upon its logical source to discover but its own position in the darkness.

It should be remembered that we have added to the mechanical conditions of the manifestation other elements, to wit, the yet mysterious and wonderful power and resources of electricity.

Let us consider for a moment the transmitter of the telephone. Here are the Baxter and the Shaw instruments, which have a considerable magnet bar of steel back of and to receive and give the vibrations of the vocal air waves against the diaphragm. Does this heavy bar of metal hum like the tuning-fork, so many vibrations for every pitch of tone and change these vibrations to those of another pitch so many times per second? Here is the molecular telephone, or the microphone we will say, a tube of glass filled with granular carbon and under some slight elastic pressure. Do these granules actually oscillate among themselves mechanically at a given tone-rate and change their dancing to a different number of strokes per second as per pitch of sound wave impulse coming to them through an elastic medium? Or why do vibrations cease here to be called such, and molecular pressure or contact of increase and decrease come in to furnish the terms and the suggestion of a theory different from that of mechanical vibration?

There was in the same number with your critic's answer a short article entitled "*Three Thousand Human Harp Strings*," in which sounds are said to be heard by deaf persons through the medium of the teeth and bones of the head. How, may I ask? Do the teeth and bones of the head vibrate mechanically at the rate of 150 to 1,000 movements per second? Strange then that the nerves of mechanical sensation are such poor strings compared with the nerves of sound audition. You conclude that article as follows: "Apparently there is a great deal more to be learned of the laws and irregularities of vibratory sensation."

Yes, indeed, there is still imperfect knowledge connected with the production and transmission of sounds. When we say a sound has an echo, we mean the sound is *reflected*. How? If a definite number of vibrations produce sounds, are these vibrations reflected? We are brought to the analogy of the undulatory theory of light. We all know that light is capable of being reflected. Again, "sound is somewhat polarized (like light), and is transmitted most powerfully in the direction of the plane in which the particles of air move." Sound also travels in many solid bodies with greater velocity than in air. In this it prefers the pathway and assumes the habits of electricity. But now, if we attribute to the telephone mechanical vibrations, strictly as such, only for the more marked, heavy, and terminated articulations of the voice such as syllabic pronounciation, as Professor Gray holds, if I rightly understand him, we have charged that instrument with its right relations to interferences by currents of induction.

If, however, we adopt a finer and more spiritual view of electrical causation through conductive media in telephonic production, we shall arrive at a more intelligible and logically satisfactory view of effects which your critic would attribute to an incomprehensible series of mechanical vibrations. I refer to the theory of Boscovith, which received also the adhesion and support of Faraday. According to this theory, atoms are mere *centres* of forces or powers, not particles of *matter* in which the powers themselves reside. In their quiescent state these *centres of force* are not arranged in a polarized form, but they become so under the influence of contiguous and charged particles. In this view we can readily believe in "*the universality of vibrations*." All *Nature* becomes spiritualized as a sensitive realm of existing equalibrated *forces*, and these forces through causation of excitation and disturbed equilibrium acting upon each other through their atoms, their centres, their stepping stones as it were, produce their effects through distance by spiritualized molecular force transmission rather than by the gross swing of organized material masses.

In the view of such a conception, light, heat, electricity, chemical affinity, sound, magnetism—in a word, the *mysterious soul* agencies of the universe come nearer to our perceptions and comprehension.

With your further permission, Mr. Editor, I shall finish in a subsequent number of your paper what I have to say of my notice of your critic's answer to my former article, by a brief consideration of induction, its nature and effects.

SIDNEY F. SHELBOURNE.

Measuring the Resistance of Ground Connections.

One of our subscribers in Russia sends us the following interesting contribution which contains information of much value to a large class of electrical men. The method described is original, so far as we can determine.

To the Editor of the Electrical World:

SIR: The resistance of earth connections, which is an important factor in all telegraph, telephone and lightning-rod work, seems to be considered by writers of electrical works as a question not worthy their attention, and while they give many elaborate and practical descriptions of the methods for testing lines, faults and instruments, they pass over "ground connections" hurriedly, only hinting in a vague way at the method of measuring them.

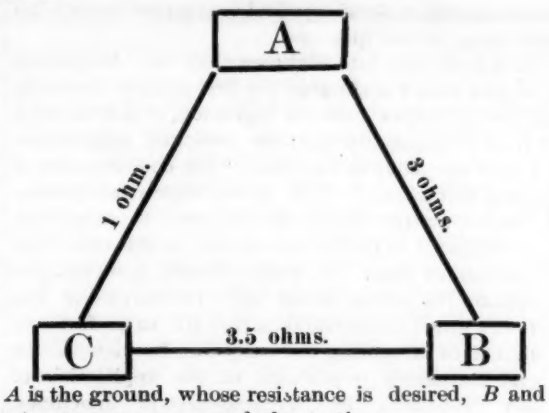
I have never seen but two methods of measuring earth connections mentioned. One by "Nystrom," using a telegraph line with all its leakage, etc., as one wire, and a temporary ground as the second testing wire, and a second by "Cully," to "measure two lines to ground through the suspected ground, and then loop them, when the difference will be the resistance of the ground under test."

Having seven exchanges under my charge and being compelled to put up lightning rods on many houses where our wires are fastened, and being under strict Government control, the question was brought seriously to my notice.

Not being satisfied with either of the above methods I have studied out one for myself, which I beg to lay before you, hoping it will benefit others, especially lightning rod men who have no telegraph wires to work from.

I think you will agree that neither of the above methods can be accurate, first, because leakage from other wires is unavoidable, and, second, the difference in potential of the earth's electricity at the two ends of a line may cause a transfer of terrestrial electricity (such transfers always occur, according to electrical writers), which must seriously impair the accuracy of the measurements.

My method entirely obviates these interferences and is as follows:



A is the ground, whose resistance is desired, *B* and *C* are two temporary grounds for testing.

As all the resistances are unknown, the first principle of the method is to find the exact resistance of either *B* or *C*, or of both.

I give you one of a number of *actual* tests.

First, measure *A* and *B*, which is 3 ohms. Of course the resistance of the connecting wires must be deducted, so as to leave the resistance of the ground only.

Next, measure *A* and *C*, which is 1 ohm. *A* being a constant resistance, we see at a glance that *B* has 2 ohms greater resistance than *C*.

Next, measure *B* and *C*, which is 3.5 ohms. As *B* exceeds *C* 2 ohms, and total of *B* and *C* is 3.5 ohms, then the *exact* resistance of *B* is 2.75 ohms and of *C* .75 ohms.

Now, knowing the exact resistance of *B* and *C* we can determine *A*'s value, by either of two methods, viz:

	Ohms.
Resistance of *A* and *B*	= 3.00
" " *B*	= 2.75
" " *A*	= .25
Resistance of *A* and *C*	= 1.—
" " *C*	= .75
" " *A*	= .25

or, joining *B* and *C* (in which case their joint resistance is their product divided by their sum), we get $\frac{2.75 \times 76}{2.75 + 75} = .5893$ ohms. Increasing *A* with *B* and *C* so joined, we now get .8393 ohms,

less .5893 " joint resistance *B* and *C*.

= .25 ohms, resistance of *A*.

This last method can be used to prove the first.

B and *C* can be very poor grounds, and not impair the test, as it is only necessary to know their value and deduct it from measures with *A*. I may probably have stumbled upon an old and well-known method (and as it is so simple I fear such must be the case), and if so I beg pardon for my innocent plagiarism.

JOHN CRAWFORD.

RIGA, Russia, Oct. 19, 1883.

The Burning of the Viaduct Manufacturing Company's Works.

To the Editor of The Electrical World:

SIR: I beg to say that our factory at the Relay Station, B. & O. R. R., was totally destroyed by fire on Friday night, Oct. 26.

We had just got things in shape to manufacture storage batteries and other electrical material on a large scale, having been preparing for this work for the last eight months. The only thing left was the water-power, for which we are very thankful; and we have commenced to rebuild. We will be in good shape again within sixty days. The loss is quite heavy, but fortunately our town

factory had not been moved to the Relay House, and our business will continue at that place until such time as the Relay factory is rebuilt.

A. G. DAVIS,
President.

BALTIMORE, Md., Nov. 8, 1883.

The Consolidated Electric Light Company.

To the Editor of The Electrical World:

SIR: At a meeting of the stockholders of this company, held on this day, the following gentlemen were elected trustees for the ensuing year: Edwin S. Thayer, H. R. Garden, Hon. William Windom, Hon. Preston B. Plumb, Judge James Keith, of Virginia, Albon Man, Henry Dexter, Horace Little, John J. Anderson, Amos Broadnax, Jacob Hays, Hubert L. Judd and Henry T. Jenkins.

NEW YORK, Oct. 7, 1883. WILLIAM RICHARDSON,
Secretary.

THE TELEGRAPH.

A CONSTRUCTION MAN KILLED.—Charles Sheldon, formerly of Elkton, Md., was killed in Pennsylvania a few days ago by a telegraph pole falling on him, while engaged in the construction of the Postal Telegraph Company's line.

A BUSY RAILROAD LINE.—The main offices of the Philadelphia & Reading Railroad Company are connected with its telegraph offices by pneumatic tubes. During business hours one day recently 500 messages were passed through these tubes.

W. U. IN THE NORTHWEST.—The Western Union Telegraph Company has nine gangs of men at work completing the construction of lines along the Northern Pacific from St. Paul to Portland and Puget Sound. An additional duplex wire has been constructed from Bismarck to Portland for through business. The company now has two wires from Portland to Tacoma, and a second wire is to be built to Seattle.

THE B. & O. WESTWARD CONNECTIONS.—On November 1 the Baltimore & Ohio Telegraph Company made direct connection from St. Louis to Kansas City over the lines of the Mutual Pacific Telegraph Company. The latter company was organized by Western business men after the absorption of the Mutual Union by the Western Union. It proposes to extend its system in time west to the Pacific coast. The Baltimore & Ohio has a close business alliance with the Mutual Pacific.

"MISLAYING" MARK TWAIN'S MESSAGE.—On Saturday last Mr. S. L. Clemens (Mark Twain) expected an important telegram. He called for it several times at the Hartford telegraph office on Saturday and also on Sunday, but received the answer each time that it had not come. On Monday morning the missing dispatch turned up, it having been mislaid in the office on Saturday. Mr. Clemens now contemplates a suit for damages against the company, according to the Hartford *Times*.

PHILADELPHIA FIRE-ALARM TELEGRAPH.—Quite a commotion has been caused in Philadelphia by troubles in the Common Council touching the fire-alarm telegraph service. Five members of the regular committee have tendered their resignation, and there are prospects of an inquiry into the shortcomings of the department. It is urged that the Police and Fire-Alarm Telegraph should be under a skilled superintendent, and that all operators should be appointed by him instead of by the Mayor.

THE INTERNATIONAL & NORTHERN.—The incorporators of the International & Northern Telegraph Company have elected these directors at New York: Christopher Meyer, Howard Meyer, Mahlon G. Martin, O. G. Staples, John F. Walton, N. S. Gilbert, John F. Moffett, Isaac Munson and Joseph Owen. The directors have elected these officers: Mahlon G. Martin, President; Orrin G. Staples, Vice-President; Joseph Owen, Secretary; John F. Moffett, Treasurer. The company has a capital of $5,000,000, and promises large additions to telegraph lines in the North and West and Canada.

THE SIGNAL OFFICER'S REPORT.—The report of the Chief Signal Officer of the army, just issued, calls attention to the injurious curtailment of the service rendered necessary on account of diminished appropriations by Congress. He urges increased appropriations for the future, and reports a deficiency bill to enable him to continue work already begun. Attention is called to the necessity of a separate office on the Pacific coast, under the charge of an instructed officer, and the report says: "If a weather service for the country is to be maintained, this important region should not be neglected as it has been." The number of stations in operation on June 30, 1883, was 376, a decrease during the year of 18.

A TELEGRAPH THROUGH THE EVERGLADES.—The Western Union Telegraph Company has written to Manager E. A. Burke, of the enterprising New Orleans *Times-Democrat*, asking that the latter's Florida Everglades expedition be instructed to make a survey of that country with a view of ascertaining the feasibility of building telegraph lines from the cable of the Western Union Company, on the western coast, through the Everglades to Jupiter Inlet, on the eastern coast. All vessels going from the West Indies and the Gulf of Mexico to Atlantic ports pass Jupiter Inlet, and the Western Union Company have been requested by underwriters and shipowners to establish a telegraph station there to announce the safe passage of vessels. The survey will be made as requested, a courier having been sent after the expedition with the necessary instruments.

A NEW TELEGRAPH SHIP.—The Monarch is the name of a vessel which has been built to the order of the English Postmaster-General, for laying and repairing telegraph cables in British waters. It is stated that the Monarch attained a mean speed of 12 knots an hour on her trial trip, which was considered highly satisfactory. Her length between perpendiculars is 240 feet, breadth 39 feet, and depth 18 feet 2 inches. She has been built considerably stronger than would have been requisite for vessels in the merchant navy of the same dimensions, owing to the special service for which she is required, and she is fitted with one pair of compound inverted cylinder engines of the collective indicated power of 4,000 horses. The high-pressure cylinder is 30 inches, and the low-pressure cylinder 58-inches diameter, the length of stroke being 48 inches; there are two main boilers 14 feet diameter, 9 feet 6 inches long, and an auxiliary boiler 9 feet 4 inches diameter and 8 feet 4 inches long.

NOT ALLOWED BY COURT COMITY.—In the suit of William S. Williams against the Western Union Telegraph Company, its Directors, and the American Union and the Atlantic and Pacific Telegraph Companies, a motion was made before Judge O'Gorman, in the Superior Court Chambers, on behalf of the plaintiff, for an order vacating the order entered on the remittitur or message of the Court of Appeals, and sending the remittitur back for a reformation of its terms. The ultimate purposes of Mr. Williams' lawyer are to apply for a rehearing on the exceptions to Judge Truax's rulings and findings, and particularly on the exception to the finding that the Western Union had in its treasury a sufficient surplus capital to represent the dividend of $15,596,520 in stock. Judge O'Gorman denied the motion, saying that the application should be made to the Court of Appeals without an intermediate resort to a lower court, which was restrained by the comity between tribunals from even suggesting to its superior that there was an error in the record or proceedings of the latter.

THE TELEPHONE.

THE MOUTHPIECE OF THE TELEPHONE may be perfectly respectable, but there are a great many things said against it.

BELL TELEPHONE COMPANY IN PHILADELPHIA.—Councils' Committee on Police and Fire-Alarm Telegraph, Philadelphia, has decided to recommend Councils to grant the Bell Telephone Company permission to attach wires to the city's poles, in order to make a connection between the various armories occupied by the National Guard and the several city departments without cost to the armories.

WESTFIELD, MASS.—The local telephone exchange has just had a new switch-board put in, arranged for 50 wires, instead of the former 25. It also has several improvements over the old board, so that the operator can attend to several calls almost at the same moment, and it allows conversation over a long stretch of line to be much more distinctly heard.

A LARGE EXCHANGE IN WALES.—A new telephone exchange has been completed which groups Swansea, Cardiff, Newport and Ebbw Vale, a distance of between eighty and ninety miles, so that these shipping ports are practically united. They are further joined to the station on Mumbles Head, and as all vessels entering the Bristol Channel call at the Mumbles for orders, the owners are now in immediate communication.

THE NEW JERSEY SHORE.—A Freehold correspondent of the Monmouth *Republican* says: At last we have a telephone. The first call was made on Asbury Park on Wednesday. It is probable that the difficulties arising from the cutting down of locust trees by the telephone company on the Long Branch road, belonging to Mr. John S. Denise and others, will be satisfactorily adjusted.

FURTHER EXTENSIONS IN MARYLAND.—Telephone construction in Maryland continues to proceed with vigor. During last week Annapolis was connected with Baltimore and Washington, and communication was established between Hagerstown and Frederick and intermediate points. The new lines are reported as working well. A charge of twenty-five cents is made for five minutes' conversation between Annapolis and Baltimore or Washington.

A WESTERN PENNSYLVANIA PROJECT.—One of the flourishing industries of which Western Pennsylvania has a monopoly is the manufacture of furnace coke, the production of which is limited, by natural causes, to a narrow area in Fayette and Westmoreland counties, where coke works are as plentiful as leaves in Vallambrosa. The distance from Pittsburgh is about forty miles, and a project is now on foot to connect the principal works with Pittsburgh by telephone.

A BODY HARD TO GET AHEAD OF.—The recent convention at Cincinnati has apparently served to impress the journals of that city with the energy and ability of the telephone workers. The *Commercial Gazette*, noting the opposition of the householders of London to the further establishment of telephone lines upon their premises, ventures the opinion that the London landlord will have to stay up all night in order to be up early enough in the morning to permanently defeat the projects of the telephone man.

TELEPHONE POLES CUT DOWN.—By direction of the City Council, Sioux Falls, Dakota, the telephone poles and wires on the principal streets were cut down on the morning of the 3d inst., by policemen, the order for the removal of the poles to the alleys having been disregarded by the company. The plant is the property of the Erie Telegraph and Telephone Company. Similar notice was served at the same time on the Western Union Company and was also disregarded, but its lines have not yet been interfered with.

THE BAXTER TELEPHONE.—A public test was recently made in Reading, Pa., of the Baxter telephone (about to be introduced in that city by the Penn Overland Telephone and Telegraph Company). The wires used were those of the Lehigh Telegraph Company. All sorts of experiments were tried, and all kinds of conversations, even down to whispers, were heard over the many miles of wire over which the test was made. The tests were made under the direction of Colonel M. H. Alberger, General Manager of the Overland Telephone Company; J. F. Burrows, General Agent, and John R. Fleck, who is to have charge of the Exchange in Reading.

SALINA, KANSAS.—Mr. G. W. Gladding, the manager of the Telephone Exchange at Salina, Kan., reports that although the institution is yet in its infancy, being not quite a year old, it has forty prompt-paying subscribers and a large number of applications on hand for instruments. The entire service has lately been rebuilt, and the company has put in for the city the Telephone Fire-Alarm system, which is giving every satisfaction. The company will shortly begin the building of a line between Salina and McPherson, with an exchange at the latter place and post stations at the principal towns between. This line will add greatly to the commercial importance of Salina.

THE NEW TELEPHONE COMPANY ORGANIZED.—The New England Telegraph and Telephone Company completed its organization at the Metropolitan Telegraph and Telephone office, New York, last week: T. N. Vail, president; W. A. Ingham, vice-president; Wm. R. Driver, treasurer; C. J. Glidden, secretary, and L. N. Downs, manager. The directors are W. H. Forbes, of Boston; Frederick Ayer, of Lowell; Stephen Salisbury, Jr., of Worcester; Theo. N Vail, of Boston; W. A. Ingham and C. J. Glidden, of Lowell; Chas. P. Bowditch, Alexander Cochrane and J. E. Hudson, of Boston. The Executive Committee remains to be chosen. The headquarters of the company are to be at 40 Pearl street, Boston.

THE OVERLAND CO. IN OHIO.—"The Cincinnati *Commercial Gazette* says that $200,000 of the stock of the Ohio Overland Telephone Company was subscribed at a recent meeting in that city, and the remaining $100,000 was expected to be taken before night. The incorporators say that with the 20 per cent. to be paid in at once they will at once establish an exchange and give the public telephone service of equal if not superior value at half the charges made by the Bell Company. They say also that they have no fears of successful interference by the Bell Company, as they have already in working order, and with bona-fide subscribers, exchanges in Philadelphia, New York, Chicago, Jersey City, Richmond, Ind., and elsewhere, and a line, through which conversation is distinct, between Philadelphia and Chicago." If such exchanges are in operation in the cities named we have not heard of them.

TELEPHONE CABLES IN CLEVELAND, O.—The telephone wires in Cleveland, O., are rapidly being put into cables, and they are working well over short distances. The company is using about 4,000 feet of cable now; about 2,000 feet of that is out of the Central Exchange to the Cedar Avenue Exchange. The longest piece is only about 1,000 feet long. The cable consists of a three-quarter inch lead pipe, in which is a cable consisting of fifty copper wires wrapped in two coats of cotton or jute, and surrounding a core of copper wire, perhaps a quarter of an inch in diameter. When this cable is introduced in the tube, melted paraffine is forced in, filling all the interstices of the insulation. This leaden tube is suspended by hangers, a foot apart, from an iron wire, No. 1 gauge in size. Each of the small wires connects an individual telephone with the exchange, while the central large copper wire is grounded at both ends, and serves to carry off the induced currents.

ELECTION RETURNS BY TELEPHONE.—Mr. Abbett, the Governor-elect of New Jersey, received at his residence in Jersey City, on the night of the 6th, the election returns by telephone, from the Jersey City Telephone Exchange, from all parts of the State. Fifteen operators were at work and the task required the utmost exertions of the entire force until nearly 12 o'clock, when Gen. Barney, the Superintendent, was able to send out the closing bulletin, announcing the majority and the result of the election upon the Legislature. These returns were received at Jersey City and sent to all exchanges and pay stations in the division, and the telephone company are congratulated upon their public spirit and enterprise as news gatherers and distributors. So does the world progress in the matter of intercommunication and intelligence. Time was when the

method of collecting and distributing election returns by mail gave way to the employment of special couriers; these in turn were superseded by the telegraph, and now the telephone is called into requisition to meet the demands of this fast age. Had any one asserted a few years ago, that a gubernatorial candidate could receive complete returns through the medium of the human voice, while seated in his own residence, and afterward receive the congratulation of his friends and supporters in distant sections of the State by personal conversation with them at their residence, he would have been regarded as a fit candidate for the lunatic asylum.

THE ELECTRIC LIGHT.

WORCESTER, MASS.—The electric light plant at Worcester will probably be completed by Nov. 15. When finished a local company will be organized to operate it.

PITTSBURGH, PA.—The Brush lamp has hitherto had a monopoly of electric lighting in Pittsburgh, but a movement is now on foot to organize an Edison electric light company in that city.

THE STEAMER WESTERNLAND.—The fine large, new Red Star steamer Westernland is now on her way from Antwerp to this port. The Siemens Brothers have fitted her up with their electric lights.

"FIRE RISKS IN ELECTRIC LIGHTING."—An electric light pole on Park avenue, Baltimore, took fire one day last week, it is supposed from one of the wires, and the fire department had to be called upon to extinguish the flame.

NEW CORPORATIONS.—New local electric light companies are reported as follows: The Circleville Edison Electric Illuminating Company, of Circleville, O.; capital, $25,000; and the Gem City Electric Lighting and Power Company, of Quincy, Ill.; capital, $40,000.

A WIDE-AWAKE NEWSPAPER MAN.—The old saying, that things are sure to jump if you put a wide-awake newspaper man at the helm, finds new vindication in the success of the Merchants' Electric Light and Power Company under the management of William A. Hovey. Mr. Hovey is well known as the late editor of the Boston *Evening Transcript.—Boston Saturday Evening Gazette.*

A HUNDRED YEARS HENCE.—A "prominent scientific gentleman" has communicated to the Cleveland *Leader* a vision of the condition of affairs in the world one hundred years hence, as revealed to him in a trance. He found, of course, that electricity was the sole agent employed for illumination and locomotion, but reports that in all his travels he did not find an arc lamp anywhere. This must be Mr. Edison.

LIGHTING THE TREASURY, WASHINGTON.—Electric lamps were suspended at the entrance of the Treasury Department, Washington, on the 2nd, by the United States Company. If they work well after 30 days' trial, Judge Folger will accept them permanently. Several electric light companies are urging him to give them the contract for lighting the entire building. Several thousand dollars a year are now paid for gas, and he has the matter under consideration.

A COMPLIMENT FROM DOM PEDRO.—A beautiful and curious object in the window of Ryder's fine-art establishment, in Cleveland, attracts much attention. It is a representation of a large plant, made entirely of the feathers of South American birds, and is a present to the Brush Electric Company from the Emperor of Brazil, as a token of his gratification upon the completion of a very successful system of electric illumination in the city of Campos, Brazil.

COST OF A 1,000-LIGHT STATION.—The Merchants' Electric Light and Power Company of Boston publishes an exhibit of its business, showing the expense of running its proposed 1 000-light central station on Congress street, and the estimated income therefrom. The deductions from these figures, making liberal estimates for expenses, show a net annual profit of about $60,000, which is equivalent to 20 per cent. on the company's capital of $300,000, when the full 1,000-light plant shall be in operation.

ELECTRIC LIGHT AND CONDUIT COMPANIES.—The ordinance granting the Metropolitan Underground Telegraphic, Telephonic and Electric Light Company the right to extend their wires under Market street, from the Public Buildings to Sixty-second street, was brought up in the Philadelphia Council last week, by Mr. Ridgway, who stated that the company had contracts with the new Bennett-Mackay Postal Telegraph Company. So far the company have made no effort to make use of their rights on Chestnut street from Thirteenth to the Delaware, but, with the assistance of the Postal Company, it was urged that an underground experiment would be made at once, and the bill was passed. In the Select Branch, the ordinance authorizing the Underground Electric Conduit to lay their conduits under Juniper, South Penn Square and Merrick streets was approved. Selectman Munroe desired to charge $5 per pole for the privilege to the Underground Electric Company to attach its wires for sixty days to the public lamps on the south side of Chestnut street, between Delaware avenue and Broad street. The Chamber, however, agreed to grant the privilege without the tax.

MISCELLANEOUS NOTES.

A NEW ATLANTIC CABLE.—A party of English engineers and electricians have arrived at Teneriffe to lay a cable between that island and Cadiz, Spain.

AN ELECTRIC FACTORY FOR CLEVELAND, O.—The Cleveland Electric Company is a new organization, with Messrs. S. E. Henderson, President; W. H. Gabriel, Secretary; J. L. Athey, W. P. Chard, W. E. Craig, D. H. Kimberley and H. W. Kitchen as Directors, and with capital stock of $100,000. Mr. C. O. Evarts is Treasurer. The company will fit up a factory on the flats for the manufacture of motors for sewing-machines, dental lathes and of electric-light apparatus.

THE VIENNA EXHIBITION.—In the presence of an enthusiastic crowd of over twenty thousand persons, the Crown Prince Rudolph closed the Vienna Electric Exhibition on the evening of the 3d inst. with a long speech terminating as follows:

"The public has shown that it is capable of estimating and valuing all the endeavors made for progress, culture and science. In regard to the scientific problems of our age the exhibition was undoubtedly a great success. Therefore we may consider as the best reward for the efforts expended on this exhibition the conviction of having done a good deed."

THE BUFFALO ELECTRICAL SOCIETY.—The second meeting of the Buffalo Electrical Society took place at their hall in the old post-office building on the 2d inst. There was a large attendance and ten new members were enrolled. An exceedingly interesting and instructive lecture on frictional electricity, illustrated with drawings upon the blackboard and suitable electrical apparatus, was given by William Finn, of the Wheatstone department. Mr. Finn is thoroughly familiar with all matters pertaining to electrical science, and avoiding as far as possible the use of technical terms his lectures are as entertaining as they are instructive. The meetings of the society occur on the first and third Fridays of each month and the doors are open to all.

ELECTRIC GATES AT RAILROAD CROSSINGS.—The Owasco River Railroad, running into Auburn, N. Y., is to be equipped with electric gates for crossings. The gates will be set over the tracks so that their tendency, through the influence of a spring at the hinge side, will be to fly open, but they will be held shut by electric catches. As the train approaches the gateway from either direction, the first set of wheels coming in contact with a spring set by the rail at some distance from the gate closes a circuit and releases the gate so that it flies open. Then the pressure of the wheels upon a double lever arrangement by the side of the track keeps the levers down until the last truck has passed through the gateway, when the lever will rise again and the gate is automatically closed behind the train. In addition to opening the gates at each crossing, as the train approaches the apparatus causes gongs to sound continuously until the gates are closed again, and also swings out two danger signals, one for the street and one over the sidewalk.

ELECTRIC RAILROAD ON MT. DESERT.—A company of Bangor gentlemen propose to build a narrow-gauge railway from Bar Harbor to Eagle Lake, Mt. Desert, a distance of three miles. The road will connect with the steamer which runs across the lake to the terminus of the Green Mountain Railway. This subject was agitated last summer, as the road from Bar Harbor to the lake is very dusty, and therefore uncomfortable to ride over in the barges. The corporation is to be known as the Mt. Desert Railway. Those interested in Bangor are Messrs. W. B. Hayford, C. V. Lord, T. N. Egery, F. W. Cram, F. M. Laughton, F. H. Clergue, C. F. Bragg, Sumner Laughton and F. W. Goodwin. There are also interested in the enterprise Messrs. Payson Tucker and William A. Allen of the Main Central Railroad. An engineering party under the charge of Chief Engineer Allen of the Main Central Railroad will at once commence the survey. The promoters are now investigating a new method for running railway trains by electric power, and it is probable this will be adopted on the Mt. Desert Railway.

STOCK QUOTATIONS.—Telegraph, telephone and electric light stocks were quoted on Thursday of last week and Thursday of this week as follows:

	Nov. 1.	Nov. 8.
American Cable	61½	63½
Western Union Telegraph	78¾	79⅛
Bankers and Merchants' Tel.	135⅝	....
Commercial Telegram	90	95
Gold and Stock Telegraph	88	....
Mutual Union Telegraph	....	17½
American District Telegraph	16	16
American Bell Telephone	205	206
Union Telephone	99	.. .
Bay State Telephone	98	98
Tropical Telephone	1¼	1
Mexican Telephone Co.	2¼	2
National Bell Telephone of Maine	67	70
New York and Pennsylvania	90	88
Boston & Northern Telephone	100	100
People's Telephone	6⅛	7½
Suburban	98	100
Erie Telephone	48	50
New York and New Jersey	85	90
Brush Electric Light	....	80
Edison Electric Illuminating	70	....
Edison Electric Light	150	....
U. S. Electric Lighting	...	112
Hudson River Telephone	....	100

BUSINESS NOTICES.

We call the attention of our readers to the Double-barrel Breech-loading Shot Gun, advertised in this week's issue by E. P. Tiffany & Co.

MEMBERSHIPS.—At a meeting of the Directors of the Electric, Manufacturing and Miscellaneous Stock Exchange, it was resolved to close the subscription books for the first limited allotment of seats at $250 on or before Nov. 17, prior to the opening of the Exchange.

Application blanks may be had of and subscriptions made through and payable to the order of

The Third National Bank, No. 20 Nassau street.
The St. Nicholas Bank, of New York, No. 7 Wall street.
The Chatham National Bank, No. 196 Broadway, or
Messrs. Hagen & Billing, Bankers No. 1 Wall street.

All applications must be accompanied by check and name and address of applicant. (The right to reject reserved). Subscriptions can also be made to, and information obtained of the Secretary, Duncan Building, No. 11 Pine street.

THE "ELECTRICAL WORLD'S"
ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

ALL THE PATENTS MENTIONED BELOW ARE DATED OCT. 30, 1883.

Circuit closer for electric alarms; L. A. Brigel, Cincinnati, O. 287,618

A flexible board is provided with intersecting wires that constitute the terminals of an electric alarm. These wires are held normally out of contact at their intersection by springs. When the board is walked upon the wires are brought into contact and the alarm is given.

Dynamo-electric machine; T. A. Edison, of New York City. 287,512

An open bed-plate through which air penetrates to the space between the polar extensions of the dynamo field magnets is the subject of this patent.

Dynamo-electric machine; T. A. Edison, New York City 287,513

A pulley of non-magnetic material is used on the armature shaft to avoid the friction and heat due to the end pressure of the shaft against its bearings, caused by the attraction of the field magnet on the iron pulley commonly used.

Dynamo-electric machine; T. A. Edison, of New York City 287,514

A casing is formed over the commutator connections and provided with air-gathering cups or fans which force the air directly upon the commutator connections and cool them. The air escapes through holes at the inner end of the casing and passes between the armature and poles of the field magnet.

Dynamo or magneto-electric machine; T. A. Edison, of New Yord City 287,523

The field magnet is formed of several flat, soft iron magnet cores separately wound and attached to two convergent polar extensions.

Dynamo or magneto-electric machine; T. A. Edison, of New York City, assignor to the Edison Electric Light Company, of same place. 287,521

The object of this invention is to produce from a dynamo two or more currents of different electromotive force on two or more different circuits.

Dynamo or magneto-electric machine; P. P. Nungesser, of Cleveland, O. 287,774

A disc having a hollow chamber and provided with air-gathering hoods or buckets is secured to the end of the armature for the purpose of gathering in the air and maintaining an air current through the armature.

Dynamo or magneto-electric machine; John E. Giles, Hazleton, Pa. 287,661

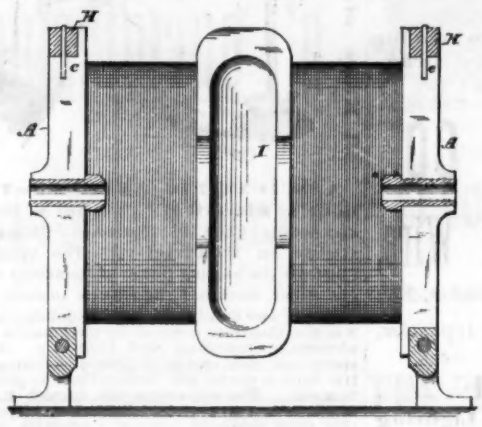
The armature consists of a disc of wood or other non-conducting non-magnetic material, with inductive wires or bars laid on the periphery parallel to the axis, and retained in position by means of binding wires running around the periphery of the disc.

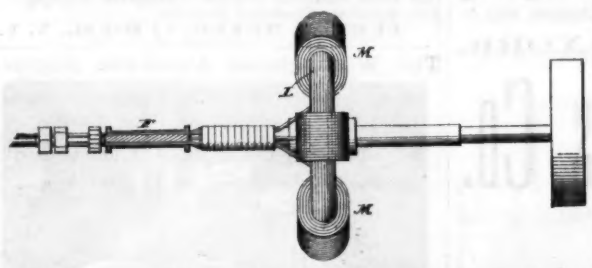
Electric flat-iron; R. N. Dyer and H. W. Seely, of Menlo Park, N. J. 287,758

An electrical heating resistance is combined with the flat-iron, and the heat is generated by the passage of the current through the resistance.

Dynamo-electric machine—Forée Bain, of Chicago, Ill., 287,608, 287,609, 287,610, 287,611

These patents cover means and methods for utilizing to the greatest extent all the effective current generated by the revolving armature, in its circuit external to the armature. The coils of the armature generating an effective current are connected to the working circuit, and the coils generating the ineffective currents are connected with a long circuit, or a





circuit of comparatively high resistance. Another method of producing similar results consists in connecting the coils generating low tension currents in parallel circuits, and the coils generating currents of higher tension in series.

Our engraving shows the form of the field magnet and armature of this machine, the magnet being shown in section with the armature removed. The field magnet is made in halves, divided on a central vertical plane in the axis of the armature. The ends *A* of the two halves are clamped together by rings *H*. In the centre of each half is formed the hollow pole piece *I*, in which the armature revolves. The armature consists of a wire ring *L* formed on a strong spider fixed to the shaft. The bobbins *M* are wound between the arms of the spider. The armature shaft is grooved to receive the terminals of the bobbins which are connected with the commutator sections, and the grooved portion of the shaft is covered with a thimble *F*.

Electric regulator; T. A. Edison, of New York City, assignor to the Edison Electric Light Company, of same place.....287,511

A galvanometer placed in the circuit directs a current through electro-magnetic pawl and ratchet mechanism that introduces more or less resistance into the field circuit, and thus controls the strength of the current in the main circuit.

Electric fire alarm apparatus; W. C. Gordon, of Langham Hotel, County of Middlesex, England..... 287,664

Electric battery; A. F. Delafield, of Noroton, Conn..... 287,641

This invention provides means for easily and rapidly filling the cells with the exciting fluid.

Electrical connection for railway signals; Thomas J. Pattinger, of Louisville, Ky..... 287,466

This is a device for making an electrical connection between the rails and an electric signal mounted on a post adjacent to the track. It is designed to obviate the liability to breakage common to wire connection.

Insulated electric conductor, H. C. Phillips of Waterbury, Conn., assignor to Holmes, Booth & Haydens, same place.

The invention consists in first treating the conductor after the last or outside coating of insulating material has been applied, with silicic acid in a slate of fine powder and then calendering the surface to compact it and render the whole smooth and uniform.

Insulated conductor; George W. McGill of New York City.....287,766

This conductor is provided with an insulating covering consisting of one or more fibrous jackets treated with water-proof material composed of glycerine and glue, with one or more additional fibrous jackets treated with fire-proof paint.

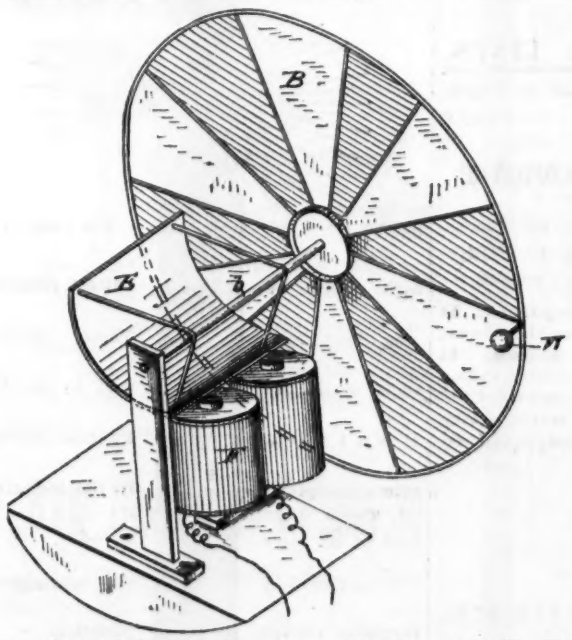
Incandescing conductor for electric lamps; T. A. Edison, of New York City, assignor to the Edison Electric Light Company, of same place.....287,520

This conductor has apertures in its enlarged end, which are electro-plated in their interiors.

Electric railway signal; W. L. Le Grande, of Louisville, Ky., assignor to the National Electric Railway Signal Co., of same place..... 287,446

The object of this invention is to secure an efficient and prolonged action of an armature.

The soft iron armature plate *E* is eccentric to its shaft *b*, and is located within the influence of the magnet *F*. The shaft *b* car-



ries a signal desk *B*, having at one side the weight *W*. This apparatus is mounted in a casing having openings corresponding in size and shape to alternate discs. When a current is sent through the magnet, the armature *E* makes a partial revolution, so as to bring to view the signal of danger or safety, as the case may be. When the current is withheld, the weight *W* replaces the desk *B* in its normal position.

Incandescing electric lamp; T. A. Edison, New York City, assignor to the Edison Electric Light Company, of same place.....287,519

Two or more parallel incandescing conductors are supported from the top of the lamps by hooks, and a cross wire connecting the two incandescing filaments.

Indicator for electric lighting systems; W. P. Freeman of Brooklyn, N. Y., assignor to Wm. F. Jobbins of same place..... 287,654

An electric signaling circuit is connected with the cut-out devices of the lamps in the illuminating circuit, and arranged to be operated by the cut-outs.

Lightning arrester; J. W. Dyer, of Philadelphia, Pa., assignor to the Automatic Current Protector and Electric Manufacturing Co..... 287,647

This arrester is not only a lightning arrester in its proper sense, but is adapted to carry off currents of high intensity and quantity, generated by dynamos.

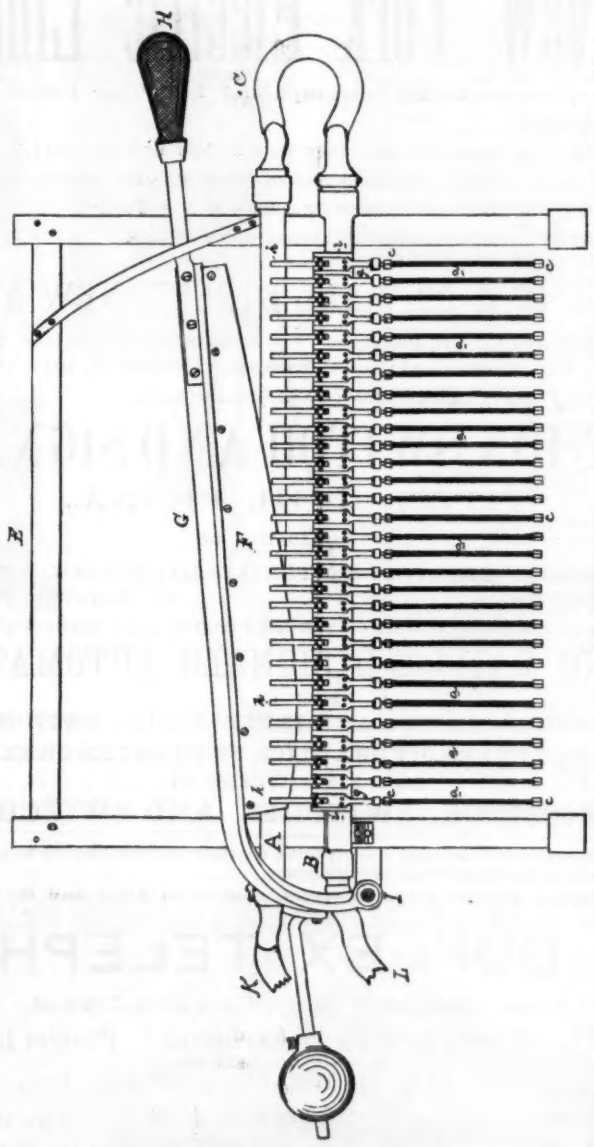
Junction for electrical conductors. Calvin Goddard; of New York, N. Y. assignor to the Edison Electric Light Co., of the same place..... 287,532

This invention relates more particularly to the enclosing box for carrying and protecting the connections, and to means for readily introducing safety catches.

Method for electrical testing, C. S. Bradley, of New York City, assignor to the Edison Electric Light Co., of same place..... 287,501

To discover the presence and location of leaks or ground-connections, caused by defects in the insulation of the conductor, the conductors and the earth are connected so that the insulation lying between them forms two of the sides of a Wheatstone bridge. The operation of measuring is then proceeded with in the usual way.

Regulator for systems of electrical distribution; T. A. Edison and Chas. L. Clarke, of New York City, assignors to the Edison Electric Light Company of same place..... 287,525



This regulator is designed to preserve a consant electromotive force or pressure in the circuits. The resistance consists of series of carbon rods *a* interposed in multiple arc between two main conductors *A, B*. Springs *h* approach, but do not touch, the upper conductors *A*. A kufi *F* of copper attached to the lever *G* may be introduced between its springs so as to bring a greater or less number of the carbon rods into the circuit. The conductors *A B* are made hollow to receive a stream of water for the purpose of cooling.

Magneto-electric machine, Philip P. Nungesser, of Cleveland, O..... 287,773

The armature of this machine has a peculiar winding, and is made hollow to receive air for cooling.

System of electrical distribution; T. A. Edison, of New York City..... 287,515

A system of main conductors is supplied by feeding circuits connecting the main conductors with the source of supply. The regulation of the current is effected by making and breaking the connection between the feeding circuits and the system of main conductors.

System of electric distribution; T. A. Edison, of New York City.....287,516, 287,517

Safety-catch for electric circuits; Calvin Goddard, of New York City, assignor to the Edison Electric Light Co., of same place..... 287,533

The object of this invention is to give to safety-catches for electric circuits a selective character, so that it will be impossible in providing or replacing a safety-catch to use one having a greater carrying capacity than required by the particular circuit.

Telephonic repeater and relay; J. A. Maloney, of Washington, D. C..... 287,449

In this repeater a condenser and battery for charging the same are combined with the relaying apparatus to throw renewed energy into the line.

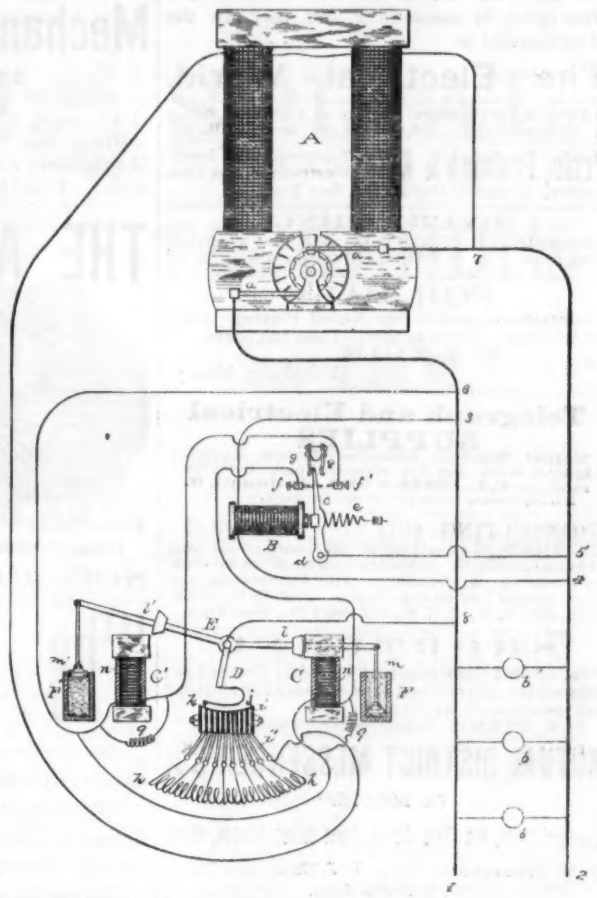
Telephone transmitter; E. L. Wilson, of Boston, Mass., assignor to the American Bell Telephone Co., of Masschusetts..... 287,490

This relates to improvements in the adjustment of the electrodes of the transmitter.

Telephone receiver; H. E. Waite and S. H. Bartlett, of New York City, assignors to the Molecular Telephone Company, of same place.....287,742, 287,743

Telephone time signal repeating system; J. M. Oram, of Dallas, Tex..... 287,710

Regulator for dynamo-electric machines; T. A. Edison, of New York ty, Ciassignor to the Edison Electric Light Co., of same place..... 287,524



The field-magnet coils of the generator form part of a multiple arc circuit derived from the main conductors, and in another multiple arc circuit is placed a controlling electro-magnet. In a multiple arc circuit 3, 4, is placed an electro magnet *B* wound with German silver, and having an armature *c*, pivoted at *d*, and retracted by an adjustable spring *e*. The armature lever *c* forms a part of the operating circuit 5, 6. Its free end is provided with contact points, which play between the points *f f'*. Spring fingers *g* hold the armature normally between these two points. The two divisions of the circuit 5, 6, include the operating magnets *C C'*.

The field magnet *A* is energized by the current in the multiple arc circuit 7, 8, in which are connected the resistance coils *H H* and the flexible contact arm *D*. The wires from the coils *h h* are connected with the fingers *i'* of the metal commutator plates *i*. The contact point *K*, attached to the spring arm *D*, rests on the edges of the plates. The contact arm *D* is attached to the middle of the pivoted bar *E*, and to the latter are attached the armatures *l l'*, one for each magnet *C C'*, and these armatures work across the face of the polar extensions of the magnets. The movements of the bar *E* are modified by dash pots *F F'*.

As the number of lamps in the main circuit increases, the decrease of current in the circuit, 3,4, causes the spring *e*, to draw the armature *c*, away from the magnet *B*, completing the circuit at *f'*, through the magnet *C'*, attracting the armature *l*, and so moving the spring-arm *D*, and contact *k*, as to remove a portion of the resistance *h*, from the full circuit 7, 8.

The removal of lamps from the current causes the magnet B to attract the armature *c* against the point *f*, causing the magnet *C* to attract the armature *l* and place resistance in the field circuit.

Underground conduit; J. S. DuBois, of Camden, N. J. 287,509

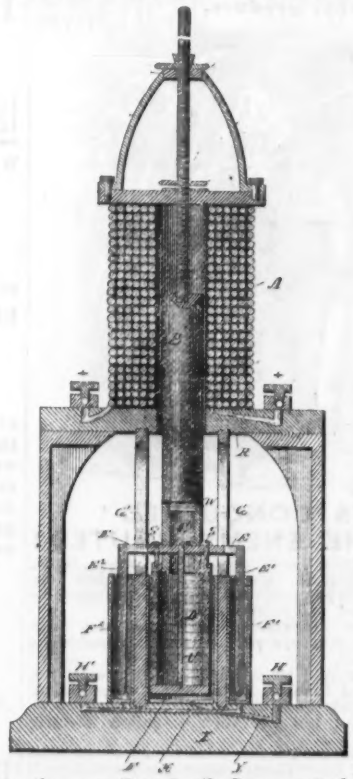
This invention relates to a peculiar method of joining the ends of metallic, longitudinal pockets to prevent the conductors supported by the pockets from becoming abraded.

Wiper for commutators of dynamo-electric machines.. 287,678

This is a device for keeping the commutators of dynamos clean and bright.

Regulator for dynamo electric machines; Geo. J. Murdock, of Binghamton, N. Y..... 287,565

This current governor consists of a helix *A*, mounted upon a support, and having its terminals connected to opposite poles of the external current generated by the armature of the machine. In the helix there is a movable iron core *B*, with which is connected a resistance pile *D*, composed of rings made of a mixture of gutta-percha and iron filings. The resistance pile moves in a mercury chamber *F*, and the current passes through the mercury and through the rings of the resistance pile to the coils of the field magnet. When the rings are immersed the resistance is slight. When the strength of the current in the



helix increases the core *B* and pile *D* are raised, leaving only rings of greater resistance in the mercury. The several rings of the pile *D* are graduated as to their resistance, the upper one having the least, the lower one the greatest.

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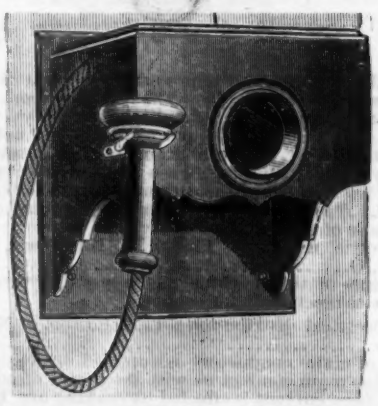

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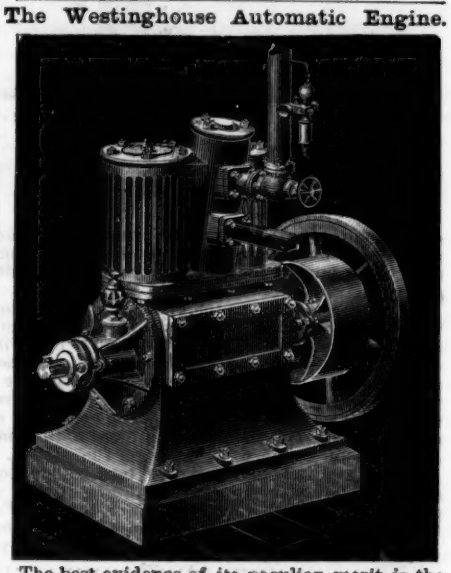

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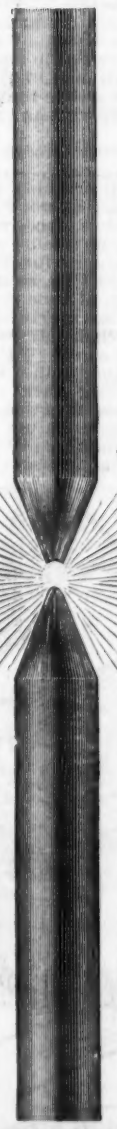

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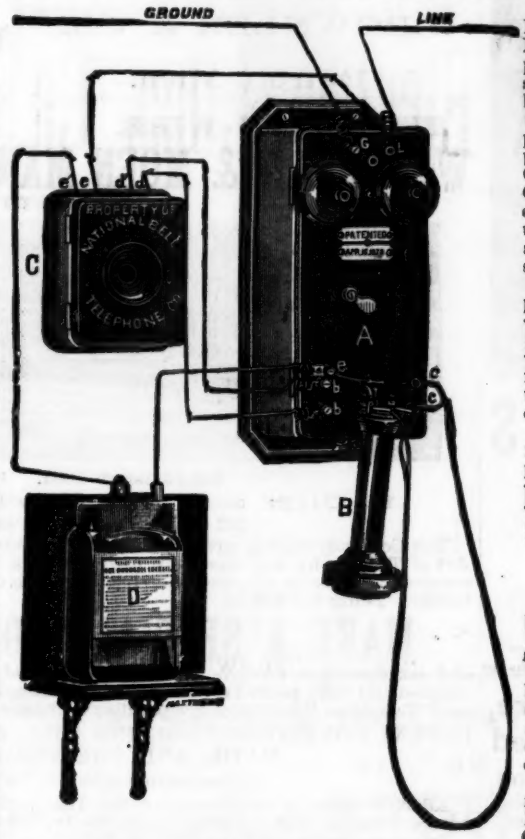

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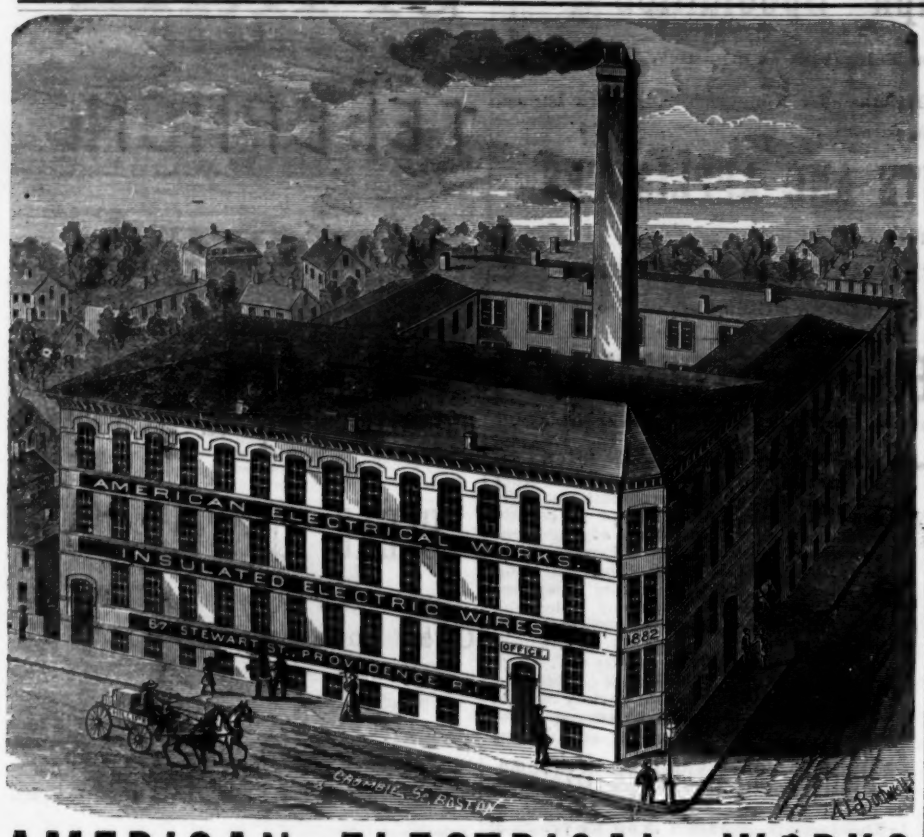

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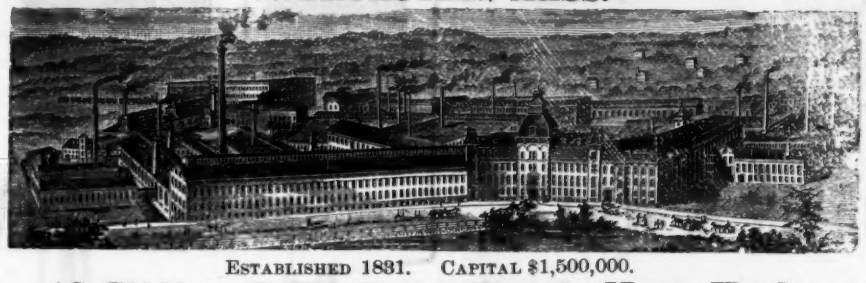

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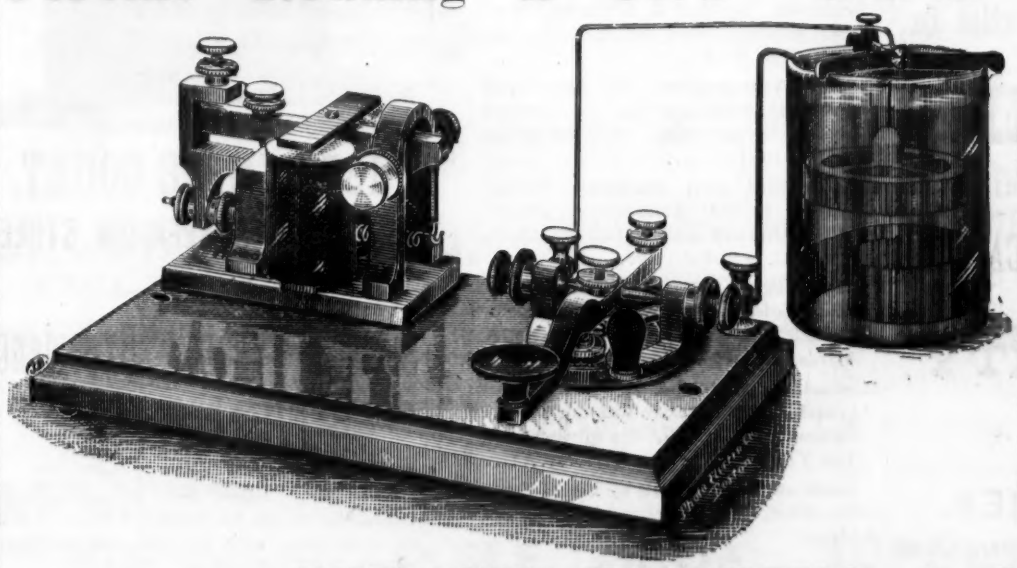

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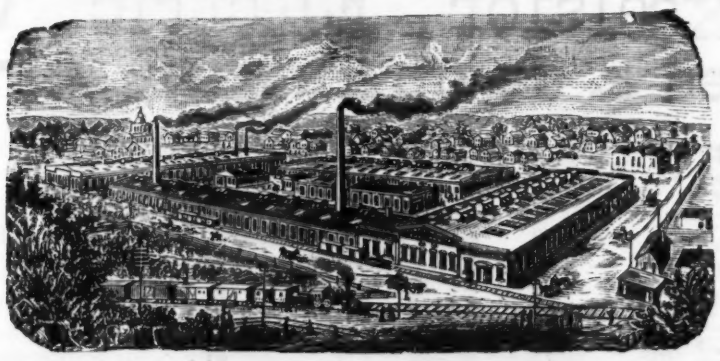

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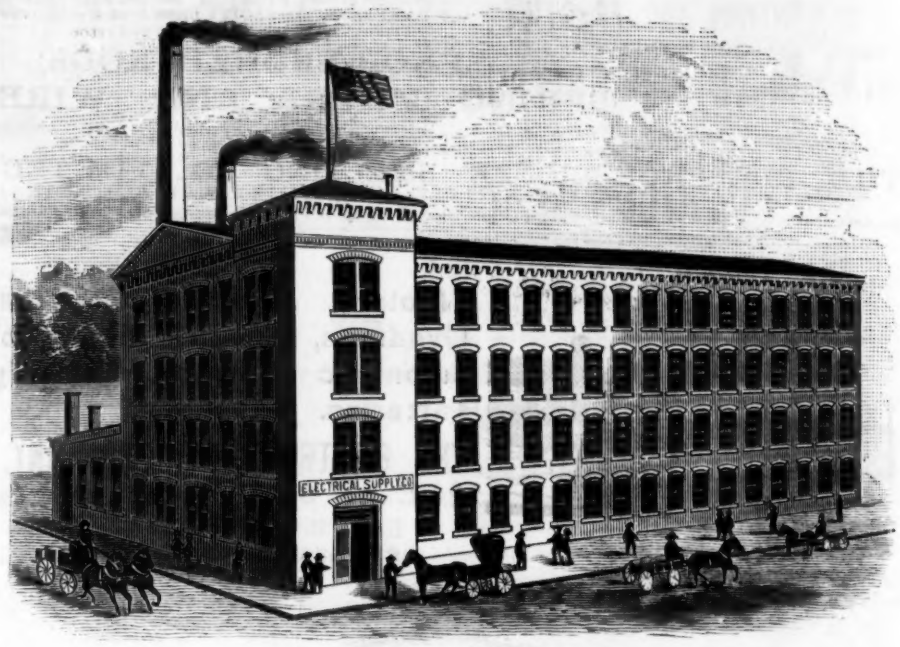

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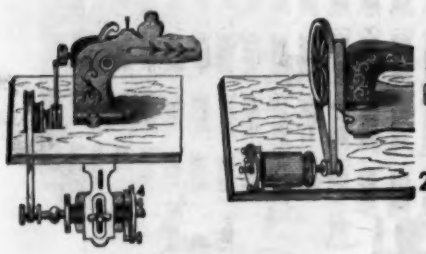

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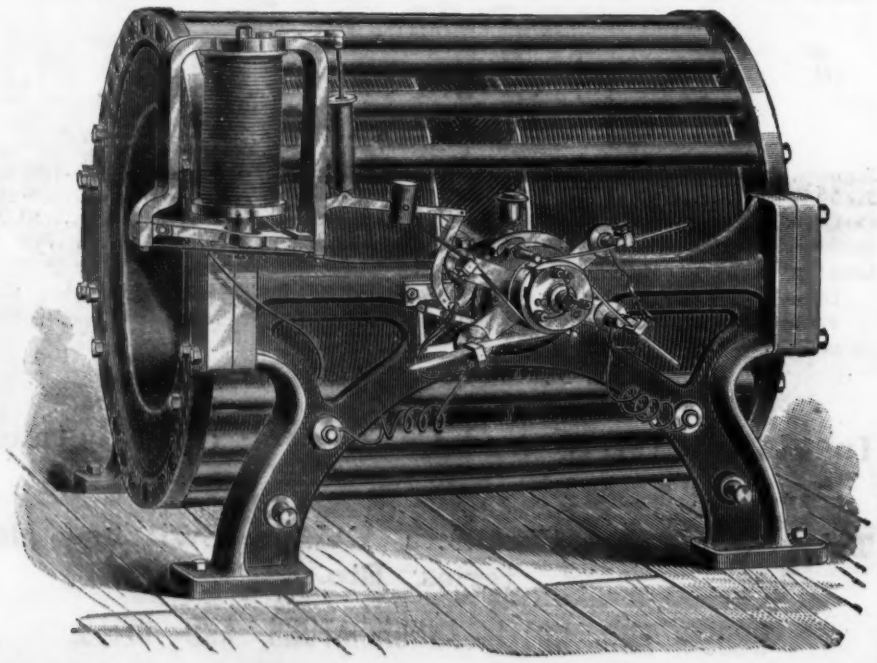

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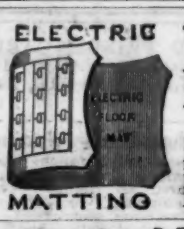

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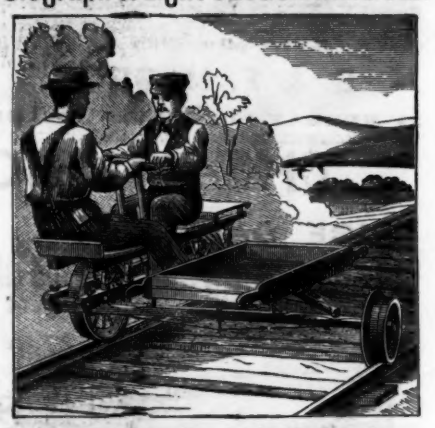

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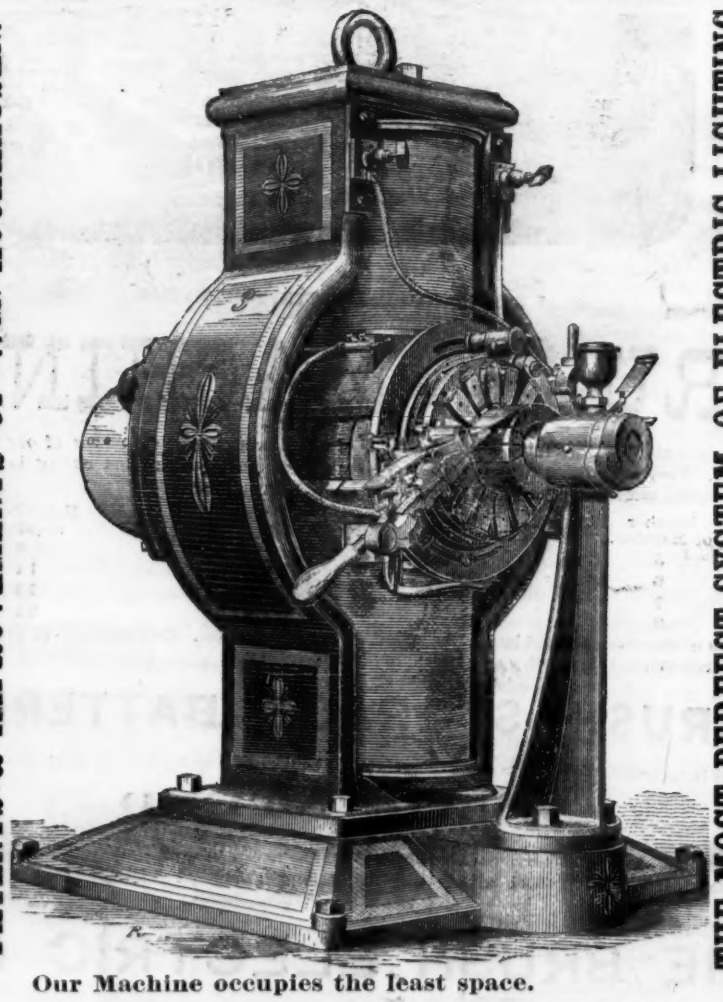

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